SCIENTIFIC AMERICAN

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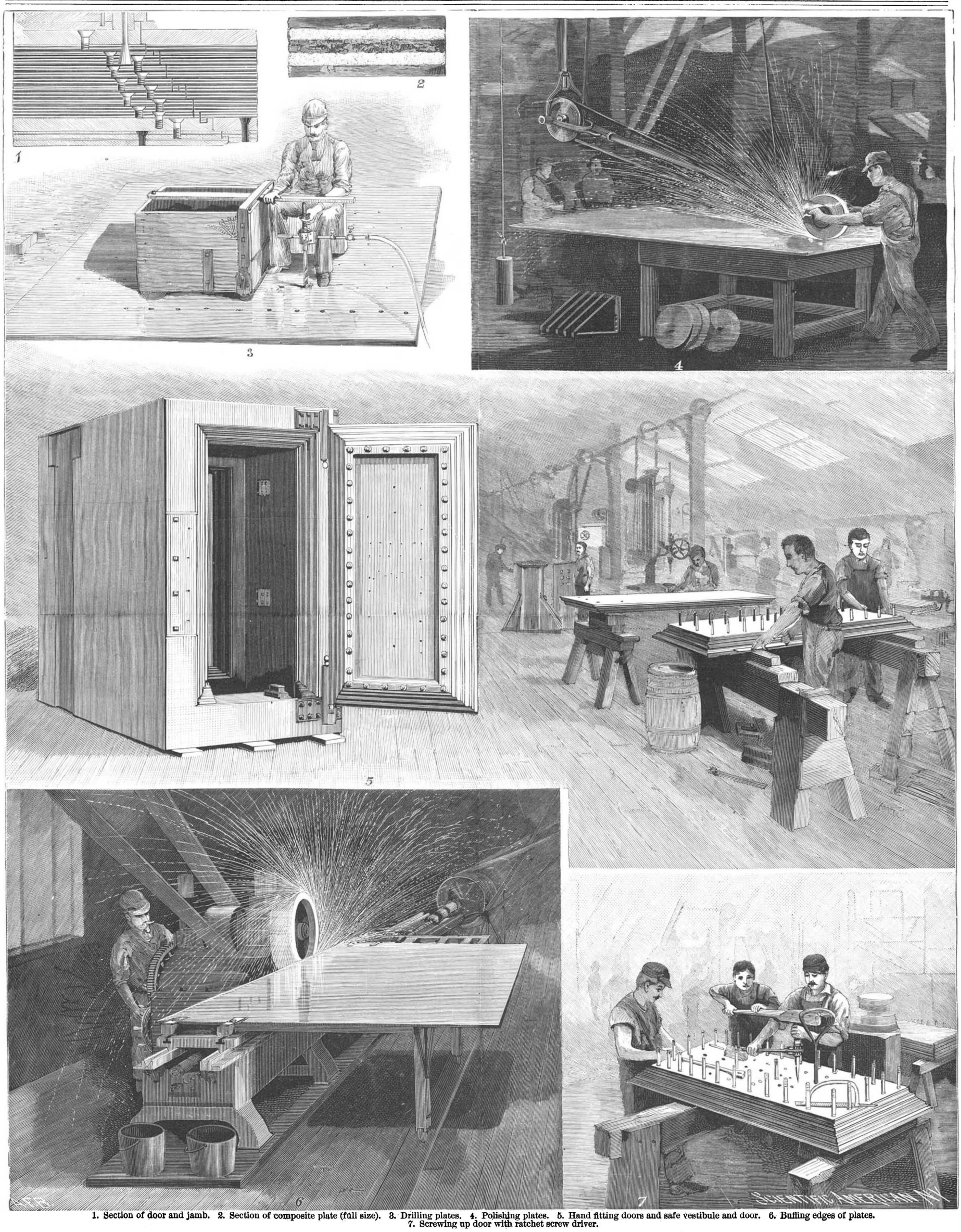

1. Section of door and jamb. 2. Section of composite plate (full size). 3. Drilling plates. 4. Polishing plates. 5. Hand fitting doors and safe vestibule and door. 6. Buffing edges of plates. 7. Screwing up door with ratchet screw driver.

THE MANUFACTURE OF BURGLAR-PROOF VAULTS.—[See page 312.]

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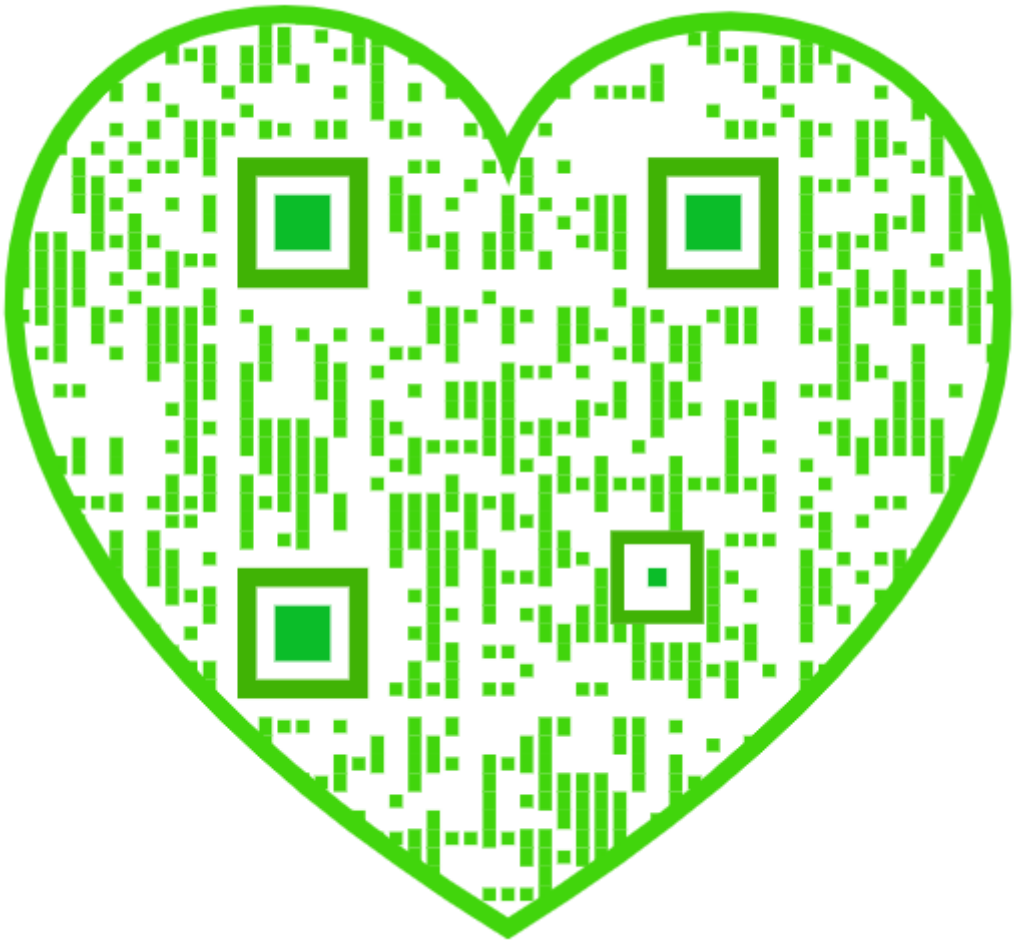

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THE PREVENTION OF NOISE.

The nineteenth century can be no better defined than as a century of wonders. The wealth of mechanical and scientific invention which has been lavished upon it has made it a veritable miracle. The true progress of the last fifty years has been such as to actually affect the popular mind, which now has reached a condition when it is hardly susceptible of further wonder. The long distance telephone was as quietly accepted as was its predecessor—the original magneto telephone. Telegraphing from trains moving at sixty miles an hour by induction through the air was tried, proved successful, and was abandoned from business motives, but it excited but a passing wonder in the public. The trolley car is used daily by multitudes of people, but few of whom ever stop to think of the wonderful achievement of the transmission of hundreds of horse power over an inert copper wire.

But the great increase in mechanical appliances and the growth of population in cities has brought about a disagreeable effect, the increase of noise. From the private office, where the rattle of the typewriter has proved the successor to the classic squeaking of the quill pen, to the street, where the traffic of carriages and carts is overtopped by the roar of the elevated railroad, our life is spent in the midst of noise. It would seem that not one field but a hundred or more fields are open to the inventor who will attack the noise problem in its minor as well as major phases. When a machine, in addition to doing its work, produces noise, the latter is pretty certain to be the indication of a useless expenditure of energy if not directly the cause of such waste.

When the elevated roads were first put into operation in New York, the noise was a source of the greatest complaint. Residents near the road, not only on the streets through which it passed, but within a block of it, were among the protestors against the constant disturbance produced by the passage of trains. The medical profession was appealed to, and joined in the protest. There were rumors of inventions to prevent it, experts were engaged to analyze the sound constituents, the people got accustomed to it, and to-day the sound is as loud or louder than ever.

Of all ordinary means of rapid transit, the elevated roads are undoubtedly the most agreeable for the passengers. Underground roads of whatever type are unpleasant. Even the use of electric propulsion does not completely solve the ventilation problem, and the absence of daylight is an objection. But to others than the passengers the elevated railroad is not so agreeable. There is little doubt that a successful invention for preventing the noise would be an improvement of the highest order. The problem might be attacked through different avenues. The wheels might be so modified as to stop the annoyance. If India rubber tires could be successfully used, the trouble would be alleviated.

As the wheels pound over the rails, the entire structure for a considerable distance shares in the vibration, and by conduction and by its own resonance adds to the sound. A soundless structure would effect the remedy. The cure might be applied as near the rail as possible, with the idea of cutting off the structure from the seat of disturbance, between the rail and wheel.

Nature has given a hint as to how the sound might be diminished in volume; after a heavy snow storm it is greatly reduced, the snow exercising a muffling effect. This indicates, at the least, the possibility of taking the whole structure in hand and of making it non-resonant, so that it would not respond to the rolling of the wheels on the rails.

Streets paved with stone have proved so noisy that city authorities are doing all in their power to replace stone blocks by something better. Asphalt in sheet or in blocks and vitrified brick in a measure decrease the sound due to vehicles. Carriage makers, in applying India rubber tires to carriage wheels, do a great service of the same order.

The whole circle of modern city life can be traversed and everywhere will be found opportunities for the abolishment of one or the other element of the city's roar. What mankind really does is to sit down and endure until accustomed. It would seem more in accordance with enlightened ideas to apply a cure to the disease rather than to learn to bear its presence.

Military Pigeons.

Major Giddings, U.S.A., has an interesting little article in the October number of Outing, on Naval Messenger Pigeon Service, and from it the following facts were gleaned: Pigeons have been used for military service since the Franco-Prussian war. France, Germany, Austria, Italy, Spain, and Portugal now have completely organized pigeon posts; some of the nations owning upward of 600,000 birds. The United States pigeon service only covers a period of three years, the principal naval pigeon station being at the Naval Academy at Annapolis, Maryland, with branches on the cruiser New York and U. S. P. C. Constellation. The intention is to extend the system until the whole Atlantic coast is covered. The plan being to have twelve main and seven secondary stations reaching from Portland, Maine, to Galveston, Texas. Speaking of how the birds are enabled to find their way home, Major Giddings says:

"The common belief that these birds find their way home by instinct is a mistake. Their flight is guided by sight alone. When a pigeon is liberated, it rises to a great height in the air in constantly enlarging circles until it catches sight of some familiar landmark by which to direct its course. When liberated from a balloon at too great a height for objects to be seen upon the earth by even its piercing vision, it drops like a plummet until it nears the earth, when it begins to wheel around in a descending spiral until it finds its bearings."

The average speed of these messenger birds is given at thirty miles an hour, and the writer thinks they will prove of the greatest service both in times of war and peace. Pigeon fanciers will find the article well worth a careful perusal.

The Growth of Boston, Mass.

The City Surveyor of Boston, Mass., Mr. Pierre Humbert, Jr., has recently published a report devoted largely to the present and possible conditions of the water front of that city, which is attracting much attention there. This report is accompanied by reproductions of some old maps of the city which are in themselves of much value to any student of municipal problems. The first of these maps is a fac-simile of one published in 1729, showing the territory and street surfaces upon which the commerce of the old town was conducted, and a second map, a fac-simile of a chart dated 1775, gives the recognized harbor entrances and channels leading to the port at that early date. At that time what is now the city proper was all but an island connected with the mainland by a strip of land so low as to be awash at extreme high tides and so narrow that during the Revolution the British dug a moat or channel across it in front of their fortifications. The area of this island peninsula was 783 acres and the area of the peninsula, East Boston and Breed's Island, was 2,218 acres.

The growth of the city advanced in a unique way by land reclamation from the sea in the nature of filling great areas of low marsh lands, first inclosed with sea walls, at such times as necessity seemed to demand, and resulted in eventually changing almost the entire topography of the original island promontory, while further suburban aggrandizement was found in the annexation of adjoining towns. The total area thus reclaimed from the sea up to 1894 amounts to 2,245 acres, of which 1,018 acres are in the city proper. A striking feature of the latter section is the fact that the greater portion of all the railroad terminals, both freight and passenger, and all the present wharves, most of the great warehouses, and a large share of the wholesale business houses are on filled land, while by far the larger part of the present residential sections of the South End and Back Bay within the limits of the same section are the result of either raising or reclaiming land from tide water. The neighboring towns, Charlestown, East Boston, and South Boston, also increased their area materially in the same way.

But while this increase in the area of the city has been so rapid Mr. Humbert finds that harbor facilities have not been developed in the same ratio. To-day the city proper cannot expect any improvement in its wharfage except by a complete remodeling of the docks, which would not produce any considerable benefit, and the same he believes to be true of Charlestown and South Boston. But in East Boston the conditions are different, and here he says the Greater Boston must look for the development of port facilities for its increasing commerce. The territory is ample in acreage and the location is favorable, being contiguous to the three great channels of the inner harbor, thus giving room for the projection of a system of docks and wharves to be gradually developed on a plan in keeping with the port and its commerce. It is in East Boston that the great transatlantic lines have already built their permanent docks and warehouses, and the railway facilities in that section are already extensive.

Since the above paragraphs were written, a special committee of the Board of Aldermen has approved the suggestion, and has had plans drawn up for eight docks, six slips and two dry docks. The total amount of water frontage is over 20,000 feet, or nearly four miles; the water area of the slips is 2,204,000 square feet and that of the docks 3,406,000 square feet. The wharves vary from 400 to 150 feet in width, and the slips from 200 to 300 feet; they are all 1,200 feet long.—Engineering Record.

The Greater New York.

At a recent election the cities of New York and Brooklyn have voted for a consolidation of the two governments, which when carried into effect will greatly increase the population and landed area of the city of New York.

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How to Make a Herbarium.

BY HELENA D. LEEMING.

To make what the early botanists called a hortus siccus, or dried garden, has become a fine art. There is but one recognized way for an American student to make a herbarium, and that is the method of preserving plants which is adopted by the colleges of this country, which is here set forth in detail. All scrap albums, sets of flowers mounted on cards, and floral groups must be relegated to the readers of souvenir books.

In selecting specimens to press, the whole plant, root and all, should be taken. If the plant is more than ten inches high, it should be bent over once or twice in a V or N shaped position. Specimens from a tall herbaceous plant should show a spray of flowers about 8-10 inches long, and a few of the leaves from the root. The fruit of a plant should always be collected and mounted on the same sheet. Seeds or pods that fall off can be kept in an envelope on the sheet.

For work in the field, a tin botany box is useful to keep specimens fresh; but a portfolio 12×17 inches, of wood, wire, or leather, and fastened with straps, is much to be preferred, as several hundred specimens can be brought home in it. It should be filled with folded sheets of unsized paper such as grocers use. These should be about 11×16 inches when folded. The fresh specimens should be laid just as they grow, without much attempt to straighten or arrange them, between the folded sheets, and crushed up in the portfolio. Plants that are wet with rain or dew are more apt to mildew or discolor than those collected in dry weather; but care will bring them out all right. Heavy, fleshy plants also need care, and may sometimes be split, as in the case of magnolias and thistles.

The materials for a press are two smooth boards, at least a hundred driers 11×16 inches, a quantity of single sheets of white grocer's paper of the same size, and a weight, of either a box of stones or five or ten bricks.

Very fair driers may be made of newspapers folded ten or twelve times to make thick pads, cut the uniform size, and basted together at the edges. But by far the best driers are the felt pads sold for the purpose. They are absorptive in the extreme, and make perfectly even, smooth specimens. Although they cost about $2 per hundred, they are the best investment that an amateur can make, for they last for years and insure perfect specimens.

When the plants are to be taken from the portfolio, which should be as soon as possible, and not over twelve hours after gathering, they are put in press as follows: Lay a board as a foundation; on it a drier; on that a sheet of white, bibulous grocer's paper; on that the specimens, which may now be straightened out and have some leaves turned over to show their under surfaces; on top of the specimens another sheet of white paper, then a drier, and so on, till all are in, when the remaining board is laid over all and the weights put on.

In twelve hours the wet driers should be replaced by dry ones, while the wet ones are put in the sunshine or wind or behind a stove. The driers should be changed again in another twelve hours, and afterward once a day for three or four days, when most of the plants will be dry. Some plants do not dry in less than a week, and some are so persistently moist that, in desperation, they have to be ironed.

The whole secret of making fine specimens lies in having good bibulous driers, and in frequent and regular changes.

The regulation size of mounting paper is 11½×16½ inches. It is a heavy white glazed paper, about the weight of a very heavy note paper. It is worth about $1 per hundred, cut, but may be obtained for less if a local paper company has the right weight in stock.

Various means are used to attach the specimens to the sheet. Ordinary glue is useful for woody stems and heavy specimens, but the neatest and most satisfactory way is to fasten each specimen down by putting several strips of gummed paper across it. These may be prepared by covering one side of a sheet of linen paper, architect's paper, or even ordinary strong white paper, with mucilage, and, when it is dry, cutting it into narrow strips.

The plants should not all be fastened in the middle of a sheet, or the pile will soon curve. They should be distributed with a certain regard for artistic effect, in various positions.

The scientific name of the plant, with its authority, as well as the name of the collector, the locality, and the date, should be written either in the right hand lower corner of the sheet, or on a 1½×3 inch label bearing the collector's name.

Either before or after the plants are mounted they should be poisoned to prevent insects from eating them, by spraying them with alcohol or benzine in which a little arsenic has been dissolved.

The genus covers for plants should be of a strong, heavy manila paper, cut so that when folded they are ¼ inch wider than the inclosed white sheets holding the species. In the lower left hand corner of these covers there should be written first the family name, and beneath it, close to the lower edge, the name of the genus—both in a strong, bold hand. In this cover all the species of one genus should be kept.

Of course all the genera of one family must be arranged together. In a small herbarium it is well to follow an alphabetic order.

No herbarium of over five hundred specimens can be managed easily unless kept in a case. Closet shelves and drawers will serve at first, but not long. A good and inexpensive kind is made like a light bookcase, six feet high, with a partition down the middle and thin stationary shelves five inches apart. Each compartment must be large enough to allow the cover sheets to slip in lengthwise. Glass doors are a great protection from dust, but few amateurs have them. —The Outlook.

Causes for Lameness.

How often our horses go lame soon after being shod by the best blacksmith, who thinks he is a scientific horse shoer, but knows nothing of the veterinary laws of conformation! He makes all conform to his iron rule or shoe with his knife and rasp. On this subject the Baltimore American says:

It is found that most maladies resulting from horse shoeing are due to an uneven and unbalanced wall (all that part of the hoof that is visible below the hair when the hoof is placed upon the ground) in connection with an undue height of the heel. If the heels are allowed to grow too high, the greater part of the weight is thrown forward upon the bone structure of the limb and the bones of the foot are forced forward against the wall in front.

Inflammation of the foot and soreness in the joints and bones soon follow such a course. If the toes, on the contrary, are allowed to grow too long, then the preponderance of weight is thrown upon the flexor tendons, which are on the back side of the foot, and these tendons become inflamed. The hoofs, therefore, must be pared in such a way that the weight of the animal is equally distributed between the bones and flexor tendons. If one heel is permitted to grow higher than the other, bruises on the high heel, called corns, will result. Horses with weak, tender, or bruised soles may for a time require leather or water-proof pads, but as the sole grows these should be discontinued. They are never required in healthy feet where the sole, which is the best and most natural protection, is allowed to grow undisturbed by the knife. Horses with corns should have their shoes made with a wide inside web, which rests upon the bars, or have for a time a bar shoe. The last nail on the inside should also be dispensed with, and the seat of the corn or bruise carefully pared out without injuring either the frog or the bars.

The Cold Storage Industry.

Money can be borrowed on butter, eggs, cheese, chickens and farm products of all kinds that will keep, as easily as on diamonds and watches. Not only is this so, but there is a great deal more money loaned on ordinary products than in all the pawn shops in New York. This is a business which is growing every year, and which has now assumed such an enormous proportion that it makes up a large part of the discount line of several banks.

Cold storage and the development of the storage warehouse business in New York have made this possible. Most of the warehouses, especially the storage warehouses, are to the banks what the pawnbroker's safe is to him, only the banks act through some one else, while the pawnbroker owns the warehouse and the capital both. Until recently it was not possible to keep long in good condition dairy products, eggs and many small fruits; they would spoil if not used within a few days after they were placed on the market. The cows and the chickens do not adjust themselves to the demand of the public, which requires in the winter an extra amount of butter and as many eggs as in the summer. As cold weather comes on, the efforts of the cows and chickens are largely directed to keeping themselves warm, with the result that their contributions to the public food supply are diminished.

In the summers before cold storage warehouses existed, the farmers had to send their milk, butter and eggs at once, so that they would be sold before they spoiled, with the result that the prices fell to such a low point that at times the shipments to the commission merchants did not realize enough to pay the freight.

Now the banks will accept storage certificates for collateral as readily as they would United States bonds, when the application for a loan comes to them through men whom they know. Every month the value of the collateral increases, and about the only possibility of loss is an earthquake or a fire, and the cold storage warehouse is regarded as an excellent insurance risk. The owners can protect themselves by insurance.

A man needs very little capital now to go into a butter, eggs and cheese speculation. He buys from the farmers and at once has the butter, eggs and chickens sent to the cold storage warehouse. He goes to the owner of the warehouse and gets a loan of 86 per cent of the value of his storage certificates on payment of the storage and the brokerage fee for getting the loan. He gives a note for the loan, which the warehouse men indorse and deposit with the storage certificates in their bank. With this money the buyer can go back and get more butter, eggs and chickens until he has enough stored to feed a country town for six months. The bank carries the loan on until winter.

Then when the rural supply of butter, eggs and chickens begins to diminish, and the market prices increase, the produce man gradually unloads his holdings, making sale from samples. As fast as he makes a sale he gives an order for the goods on the cold storage warehouse man, receives the money and takes up the storage certificates from the bank. When all the loans are taken up, the produce man owns absolutely the rest of the things he has stored, and he can do with them what he pleases.

Some produce men enlarge this speculation by making contracts with their customers by the year. They agree on a price from month to month, and at those prices they agree to furnish a fixed quantity. The market quotations may be higher or lower than the agreement. The produce man's profits come in the difference between the prices at which he buys in the summer, plus his warehouse bill and interest charges, and the price he gets.

It may be well for some one to point out to the farmers who are in the habit of railing at New York banks and capitalists that if no one would loan money on butter, eggs, chickens and small farm products, only so much of those could be carried as the individual capital of the produce men would permit, and prices in the summer would be much lower. The fact that the New York banks will loan money on these products prevents the low drops in price that used to come every summer at the expense of the farmer. It also lowers the price paid by the customers in the city during the winter, for all the farm products stored in the summer and fall have to be sold during the winter to prevent their running into the lower prices of the next summer.—New York Sun.

Planting Potatoes in the Fall.

There has been some discussion in the agricultural press about fall-planted potatoes, some averring that this method was not practicable, while others have found it to work to advantage. A friend who tried a small patch last fall explained to me his method, and is so pleased with the result that he will plant quite an acreage this fall.

In the latter part of October he planted a small piece in drills, cutting the tubers in generous pieces, and covering them some five or six inches deep with earth; over this he placed a mulch of straw six inches or more thick. No more attention was given them until the fore part of May, when the straw was raked off and the ground allowed to thaw. The potatoes made an early start, were kept clean of weeds by frequent cultivations, and, in spite of the severe drouth, matured a fine crop, mostly of large-sized tubers, which he harvested the second week in July. It is not generally considered necessary to cover the ground with a mulch as a protection in the spring, for that would prove a serious drawback when more than a very small acreage is planted; but the most serious objections to this method seem to be a liability of the seed rotting during the wet weather in early spring, unless they are planted on well drained or naturally drained ground, and a likelihood of the plant starting too early and being caught by late frosts. But in spite of these drawbacks the double advantage of having the crop in early, and doing it when there is more time than in the rush of spring work, would make fall planting popular if the farmers generally are assured that it can be done successfully.—L. E. K., in Country Gentleman.

Remedy for Leprosy.

Mr. E. H. Plumacher, United States consul at Maracaibo, Venezuela, sends us a detailed statement showing the apparently successful treatment of leprosy by means of a new remedy, the test having been made during a five months' trial, under carefully noted conditions, in the lazaretto at that place. The trials, however, have not been carried to the conclusion of complete cures, and the consul desires to interest others in the matter, that aid may be afforded for a continuance of the experiments. Those making this disease a specialty may find it of advantage to communicate with Consul Plumacher.

HAND cosmetic, for those who desire soft, white hands:

℞	Lanolin	20 parts.
	Glycerine	20 parts.
	Borate of soda	10 parts.
	Oil of eucalyptus	2 parts.
	Essence of bitter almonds	25 drops.

M. Sig.:—Rub hands with preparation and cover with gloves at night.—L'Odontologie.

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The Disappearing Photograph.

A sheet of ordinary white, unsized printing paper, or blotting paper, is to be immersed in a liquid made by dissolving twenty grains of gelatine in an ounce of water. When the paper is thoroughly saturated, it is to be hung up to dry. After thorough drying, it is to be floated for three or four minutes on a mixture of one part saturated solution of bichromate of potash to two parts water, and again dried. The paper is now *sensitive to light*, and must be kept in a dark place. By exposure to the sun under a negative, for a sufficient time, a brownish print is produced, which is first to be soaked in cold water, until the unaltered bichromate of potash is dissolved out, and then in warm water, which removes all the gelatine that has not been rendered insoluble by the combined action of bichromate of potash and light. On the completion of this operation, the picture is still visible, in a faint brown color, but, by immersion in a solution of sulphurous acid, this color is bleached out, and, on drying, the paper appears perfectly white all over, without the faintest trace of an image. In order, however, to bring out the image, all that is necessary is to immerse the paper in what the British Journal calls "hydroxyl monohydride," in other words, clean water, whereupon the picture plainly appears, in white on a dark ground. On drying, it disappears again, and the process may be repeated as often as desired.

Java Tea and Coffee.

W. C. Knoofe, a rich coffee and sugar grower of Java, is among the recent arrivals at the California, says the San Francisco Examiner. He has lived in Java ten years and has large and flourishing plantations.

He told an interesting story recently about this queer country, for so many years under the control of the Dutch, and said that few persons understand the strange conditions of life there.

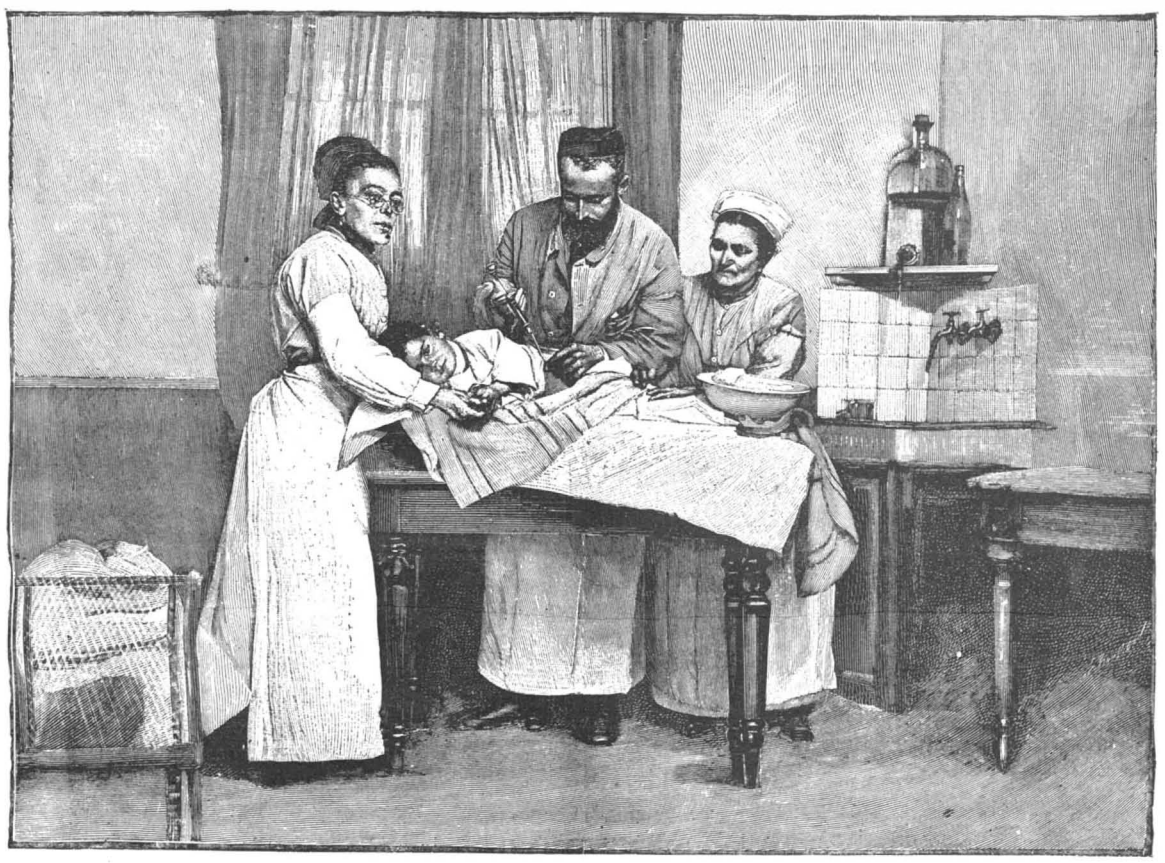
"You never saw such happy people anywhere as these little Javanese. They are always talking, laughing and dancing, and seem never to have any sort of care. They work in the tea, coffee and sugar plantations for 8 or 9 cents a day, and the best of them never get over 10 or 12 cents. Yet they are entirely contented. The women, who are the best for tea picking, do not get more than 4 or 5 cents a day. The tea is cut every forty days, so that there is always work to do. There is a big yield this year, and it is good tea, but it isn't worth much. We got word from Amsterdam, where much of our tea goes, that it was worth only from 9 to 10 cents a pound.

"With coffee and sugar the price is different. There never was as much money in sugar as at the present time. It is worth from $3.20 to $3.60 for each picul, or 134 pounds. The growers are getting rich. Both the coffee and sugar crops are very large, and like the tea, they are very fine. Coffee has veered around so much that there is no longer much money in it. All that is grown must be sold to the government. That is a requirement. It is cheap. In Holland it is worth but $6 for each 134 pounds.

"All the labor used is Javanese. It would not pay us to employ any other, and, though the wages are small, the people are probably the happiest on the globe. Their wants are few, the climate is so mild that little is worn, and they are as jolly as the day. There are 24,000,000 of them, and the Dutch government has never had the slightest trouble with any of them."

THE NEW CURE FOR DIPHTHERIA, CROUP, ETC.

If the facts placed before the Hygienic Congress held at Budapest last month be not overstated, then the whole world owes a deep debt of gratitude to the young French savant, Dr. Roux, for the patient and heroic researches which have led to the discovery of an effectual cure for croup and diphtheria, and opened the way for further results not less startling. Such is the introductory announcement in the London Daily Graphic, which also gives the following:

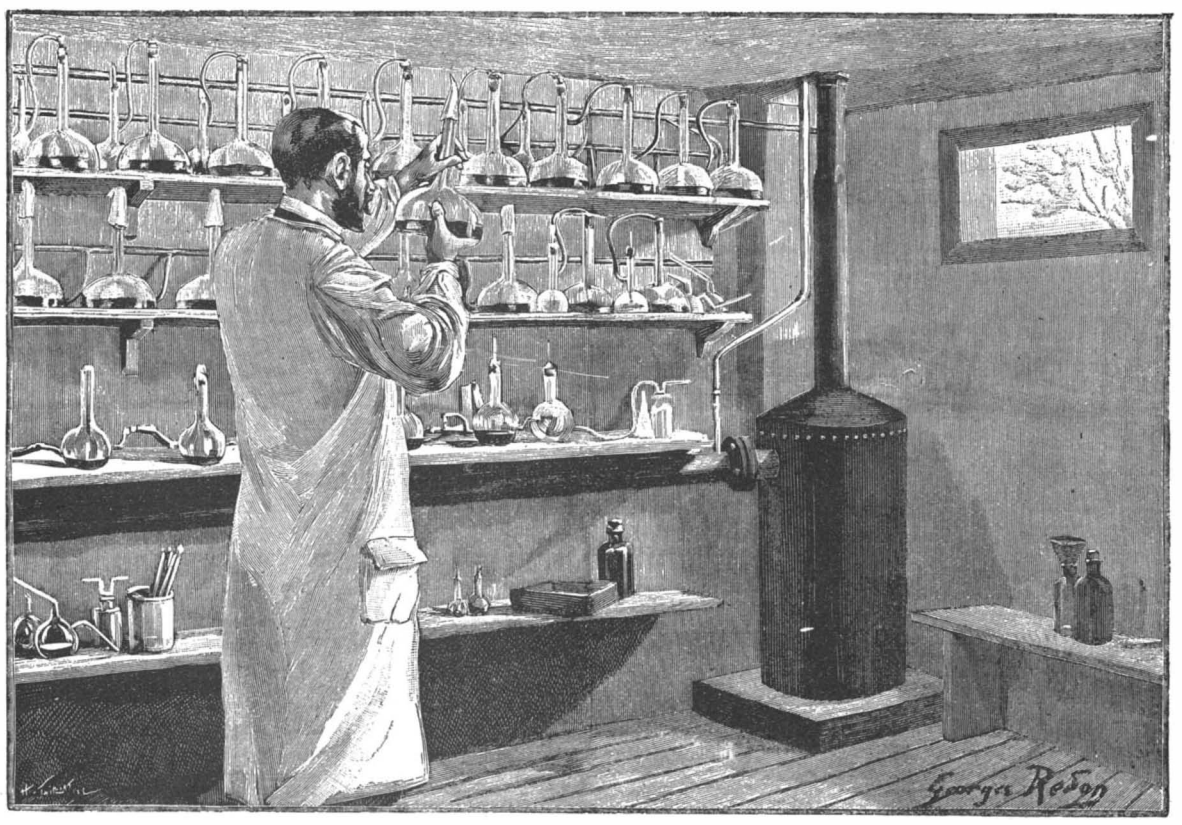


THE NEW CURE FOR DIPHTHERIA, CROUP ETC.—INJECTING THE SERUM.

The distinguished Dr. Marsan points out how the new method was established. Diphtheria is produced by microbes which plant themselves in the membrane of the throat, and multiply; but unlike the bacilli of other infectious diseases, they remain obstinately in the same position, neither penetrating the system nor the blood. But if the deadly animalcules remain at the door, they are still able to secrete a poison of extreme violence, called "toxin," which quickly penetrates the circulation and infects the whole body. This toxin, thanks to the achievements of science, can now be isolated, and in the form of a fine powder will cause almost immediate death when injected into animals. However, it has been found that if a very small dose be introduced into certain animals, especially the horse, only a feeble reaction is produced. By repeating the operation, with gradually increasing doses, the organism of the animal finally revolts, and becomes not only impervious to the toxin, but destroys it, and from this singular result is due the origin of the new substance with which Dr. Roux wages war against diphtheria. In a word, it is the basis of a great revolution in the medical world, which henceforth will recognize in "Serum therapy" a heaven-sent system to root out most of the diseases connected with childhood. As Dr. Marsan well says, there are toxins and antitoxins for all microbic affections. Serum therapy will eventually discover a remedy for all infectious diseases. Yesterday it was tetanus in animals that it cured, to-day it is diphtheria, to-morrow it will be tuberculosis.

If you go to the Institut Pasteur, you will find comfortably stalled in the garden some ten or a dozen cab horses, in prime condition, aged from six to nine years, whose mission in life it is to furnish the precious fluid which every day snatches many a young life from an untimely grave. They are in their measure unconsciously solving the problem of how to stop the depopulation of France. They are well cared for, there is no cruelty in the process, no suffering entailed. The first process is to inject the deadly virus—the toxin—into the shoulder of the horse. This, of course, at first causes a slight indisposition, but after a while no ill effect is felt. The second step, as shown in one of the views, is to draw from the neck of the "prepared" animal a judicious quantity of blood. If the blood be allowed to stand for a while, the red corpuscles settle to the bottom, and the operator can then draw off the fluid, of a yellowish hue, resting above and containing the serum, or antitoxin. This, in its turn, is injected under the skin of the patient by means of a syringe analogous to that used for injecting morphine.

On February 1 of this year Dr. Roux began operations at the Hospital for Sick Children, Paris. He had a good supply of serum, and each day on making his visit to the hospital, he treated all the children he found there, in whatever state or condition of croup or diphtheria. There was no selection of subjects, a point to be borne in mind, nor was the ordinary treatment in any way modified or set aside. Things went on exactly as they had before, except that a new element had been introduced—namely the serum. During 1890, 1891, 1892, 1893, before Dr. Roux began his system, 3,971 children suffering from croup and diphtheria were admitted into the Hospital for Sick Children. Of these 2,029 died of the disease, the mortality thus being 52 per cent. On the other hand, from February 1 of this year up to July 24, the date up to which Dr. Roux furnished statistics to the Congress, the serum was applied to all without exception, and, out of 448 children, there were only 109 deaths—that is, the mortality had decreased to 24 per cent. As the conditions during these periods were the same, the difference between 52 per cent and 24 per cent indicates the indisputable benefit derived from Dr. Roux's treatment. If we take the same period at the Trousseau Hospital, Paris, where the old methods prevail, we find that out of 520 children admitted there, 316 died, thus giving a mortality during the months in question of 60 per cent.



THE NEW CURE FOR DIPHTHERIA—PREPARING THE TOXIN.

But this is not all. The serum, if applied, say, to a child suffering from quinsy, not only puts that ailment to flight, but renders the subject impervious to croup and diphtheria; and even measles and scarlatina are found to be of very rare occurrence, and then only of slight character, when the system has been fortified by

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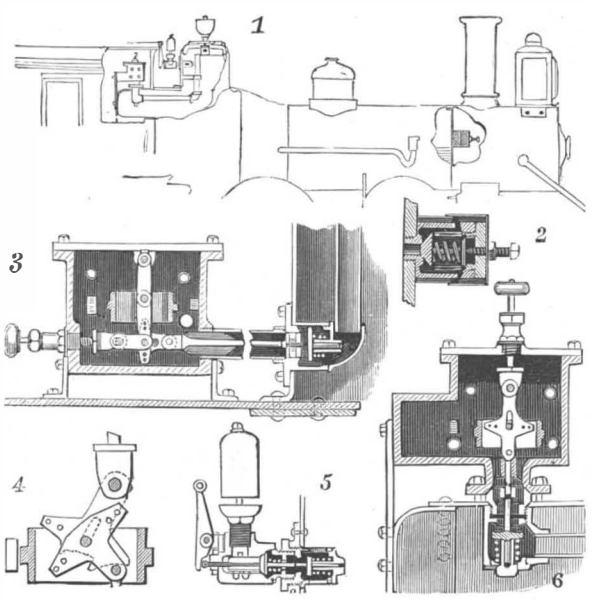
Dr. Roux's wonder cure. The 24 per cent represents the saving of the lives of 120 children in six months in one institution. The gain would have been more considerable but for the deplorable hygienic conditions of the Hopital des Enfants Malades. Many of the deaths, too, were a result of further complications, such as heart disease and broncho-pneumonia, which made the work of the physician very difficult. Generally speaking a single injection is sufficient, and Dr. Roux

THE NEW CURE FOR DIPHTHERIA—DRAWING THE SERUM FROM THE HORSE.

has never given more than two. The dose consists of two-fifths of amount of serum injected into the side by one puncture. The temperature then decreases, which is an excellent beginning. The leather-like membrane which is suffocating the little sufferer ceases, within twenty-fours, to increase, and after thirty-six hours it comes away altogether, and the diphtheritic bacilli disappear. The serum also has a marvelous effect on the appearance of the patient. The dull and leaden complexion, with its accompanying piteous cry, gives place to a healthy skin, and the patient becomes cheerful, if not gay.

AN IMPROVED LOCOMOTIVE BOILER.

To prevent the escape of steam from broken pipes, valves, etc., in case of accident to the locomotive, thereby doing away with the danger from scalding, is the object of this improvement, which has been patented by Mr. G. A. Akerlind, Erie Hotel, Dunkirk, N. Y. The invention consists principally of a spring-pressed valve normally held open, and adapted to close automatically in case of a shock to the locomotive, or in case the steam conveying pipe of the boiler is broken off, there being also an auxiliary safety valve in a sheltered place on the boiler, set to a higher pressure than the ordinary safety valve. Fig. 1 is a side view, showing the improvements applied upon a locomotive, Fig. 2 showing the auxiliary safety valve in the smoke arch, and Fig. 3 being a modified form of the improvement as arranged for the general steam distributing box. Fig. 4 is a side elevation of the weight for holding the valve and parts in position after a shock to the locomotive, and Fig. 5 is a sectional plan view of the



AKERLIND'S LOCOMOTIVE BOILER.

link connection for the weight, Fig. 6 showing in side elevation the application of the improvement on the steam distributing box for the injectors, air pump, blower pipe, steam heating system, lubricators, etc. The steam supply pipe from the dome leads to a valve connected with a bushing fitted into an opening in the shell of the boiler, as shown in Fig. 6, the outer end of the bushing being engaged by a general steam distributing box, from which the steam is distributed by pipes to the various parts of the locomotive. In case of an accident carrying off this box from its support on the shell of the boiler, or any sudden shock to the box, the valve will be automatically seated, the steam being in every case shut off. For the whistle, for the safety valve in the top of the dome, and for the injector check valve, similar automatically working check valves are provided. The inventor has lately received a prize as a successful competitor for a design for a consolidation engine to which this system was applied.

Regulation of Mineral Water Traffic.

The Academie de Medecine, of Paris, as the result of a close investigation of the trade in the so-called "natural" mineral waters of France, has arrived at the following conclusions, which are put in the form of recommendations to the legislative bodies:

1. That the sale of natural waters, impregnated with supplementary gases, should not be allowed.

2. Every application for permit to carry on the business of the sale of natural mineral waters should be accompanied by certificates, made before the proper authorities, that the waters handled or to be handled, by the applicant, have not been so prepared (i. e., by supplementary carbonification), and by a further certificate on the part of the owner of the spring, or of the source of the water, that he has not had recourse to supplementary gasification.

3. All reservoirs used for mineral water should be made air-tight, and should be emptied at least once in every twenty-four hours; they should be so constructed that the water of the spring flows directly into them; and, further, all bottles and containers should be thoroughly sterilized, and all impurities of every description should be removed before they are offered for sale.

4. These regulations should be at once imposed and all proprietors of springs of mineral waters should be forced to put them in practice within three months from date.

In France the recommendations of the Academie carry almost the weight of an order, and there is but little doubt but that the above regulations will soon be in force, so far as commercial waters for home consumption are concerned. If they are made to apply to all waters, those for export as well as those for domestic use, there will be a fearful falling off in exports, as it is well known that every single bottle of foreign, so-called "natural" carbonated waters—not merely those of France, but those of Germany, Austria and other countries—that goes abroad, goes charged with supplementary gas. Not merely this, but nearly every one of them is doctored otherwise to an extent that should remove them entirely from the category of natural waters.

Every one who has given the matter any attention knows that the mineral contents of nearly every natural spring vary with the seasons, becoming more concentrated in long dry spells and correspondingly weakened by rainy periods. In order to make the yield uniform the proprietors are forced to add water from other sources in the first instance, and to supplement the natural salts by the addition of artificially prepared chemicals in the second. The gasification is nearly all supplementary.

From "doctoring" the true waters of the springs to manufacturing the product outright is but a slight step, and hence we find some of the great mineral water companies annually exporting to America, alone, millions of bottles of water in excess of the output of their springs. By a strange ruling of our customs officials, these manufactured mineral waters have been allowed for years past to come into this country as "natural waters," and thus not merely to enter into competition with our domestic products, natural and manufactured, but to "hold the age" on the latter as "the product of nature's laboratory," a fetich of great power among the unthinking multitude.

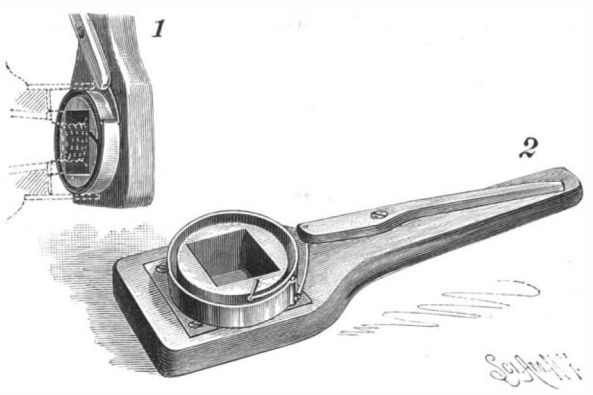
The steps suggested by the Academie, by showing the French people what poor stuff their natural waters really are, may have the effect of waking other governments up, and thus lead to legislation in this direction. If so, nothing but good can come of it.—National Druggist.

Annual Convention of the American Institute of Architects.

The twenty-eighth annual convention was held in this city, October 15, 1894, in the Fine Arts building; 105 members being present—a larger number than usual. President D. H. Burnham of Chicago delivered an interesting address, in which he deprecated the practice of showing designs to customers without payment. Other interesting papers were read and discussed. Secretary Stone read the annual report of the Board of Directors, from which it appears there is a membership of 475 fellows. There are also 26 chapters, chartered by the Institute, having an aggregate of 600 members, of which about 500 are practicing architects, and from these members the fellows are chiefly selected. The New York Chapter has the largest membership, namely 86, of which 60 are practicing members, the remainder honorary and junior. Illinois has 82 members, of which 80 are practicing. Philadelphia 55, of which 31 are practicing. The other chapters range from 8 to 20 members. The next convention meets at St. Louis. Daniel H. Burnham, of Chicago, was re-elected president; William S. Eames, St. Louis, secretary.

A CARRIAGE WRENCH.

The illustration shows a wrench more specially designed for conveniently removing the nuts on the axles of vehicles. The improvement has been patented by Mr. Julius L. Stambaugh, of Standart, Texas. Fig. 1 shows the wrench applied to the nut in the wheel hub and Fig. 2 is a perspective view, with the clamping



STAMBAUGH'S CARRIAGE WRENCH.

spring closed, ready to apply. The device comprises a cap adapted to engage the nut, and a spring band encircling the cap has one end secured to the body adjacent to the cap, while the outer end of the spring band is connected by a link with the forward end of a lever fulcrumed on the handle. The spring band engages with sufficient force the hub of the wheel, so that when the latter is turned in the right direction the wrench is carried around with the wheel, and the nut is thus unscrewed from the threaded end of the spindle.

A Horse's Sense of Locality.

About the year 1856, says the Lewiston Journal, a little colt was born on a farm in Aroostook County, in the State of Maine, a colt that was soon sold away from the place, to come shortly after into the possession of a physician in the town of Houlton, who at the opening of the civil war went "to the front," taking with him for cavalry service the colt, that had now reached maturity. Through all the vicissitudes of a five years' campaign this horse followed the fortunes of his master, being wrecked on the Red River expedition and suffering various other disasters, to return at the close of the war to the State of Maine, across which he carried his master horseback until the town of Houlton was again reached.

On the journey through Aroostook County the road traversed lay past the farm where some ten years before this horse had been born. Neither his life between the shafts of a doctor's gig nor five years of war campaigning had caused him to lose his bearings, and when he reached the lane that led up to the old farm house he turned up to the house as confidently as though he had been driven away from it but a half hour before.

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How Birds Sing and How They Fly.

This was the subject for consideration at a recent meeting of the Boston Scientific Society. The Boston Commonwealth says: The speaker was Mr. C. J. Maynard, the well-known naturalist. This gentleman has been interested in birds from an early age, and more than twenty-five years ago he began making anatomical studies of them, with particular attention to the larynx. He has himself examined the throats of the majority of the birds of the east coast of this country and the Greater Antilles.

A general division may be made into birds which sing and birds which do not. The anatomy shows clearly this division, and from the position and kind of muscles or membranes the bird may be referred to one or the other of the classes independent of auricular evidence. The larynx which birds use in singing is not the upper larynx, but an inferior one, placed just at the top of the bronchial tubes. There has always been a difficulty in bringing the matter to the attention of students in the lecture room, but recently Mr. Maynard has succeeded in making casts of the vocal apparatus of certain birds, which are soon to be introduced into certain schools. He exhibited these casts and made clear by them the muscular arrangement of the larynx of the crow, which he had selected because it can really sing and can modulate its voice to a considerable extent. This fact is not generally known, but at certain seasons the male crow has a very pretty song. The vocal apparatus of the crow is very perfect, some crows being able to talk, as can the raven.

Aided by the models, of which a dozen or more were distributed among his auditors, Mr. Maynard named and described the different muscles of the larynx and stated their purpose, these muscles being not the mechanism producing the sound, but serving to control the tension of the larynx or of the vocal membranes which lie at the top of the bronchial tubes. Of the vocal membranes, there are normally two, but in some variations there may be but one, and in some cases even this is wanting. The different tension of these vocal membranes in conjunction with air expelled through the throat produces the sounds which we hear from the birds.

While the vocal chords are usually present, there are, as might be supposed, some very wide variations in the exceptions. The humming bird, the note of which resembles very closely the squeak of a mouse, has a sphincter muscle governing the tension of its larynx. The turkey buzzard has no chords at all, and the only sound which it can make is a hiss, such as would result from the expulsion of air through an open tube. The owls hoot by the vibration of air within their great larynx. The swan has a very long larynx, which is bent about much like the convolutions of a trumpet, and the note is resounding and trumpet-like. In the wild goose, the vocal mechanism is of exceeding delicacy and beauty: the bronchial tubes are themselves the vocal chords or membranes, being delicate and transparent throughout their entire length. By means of this, the clear and musical note of the wild goose is produced. The most singular of all the vocal mechanisms of birds is that of the American bittern.

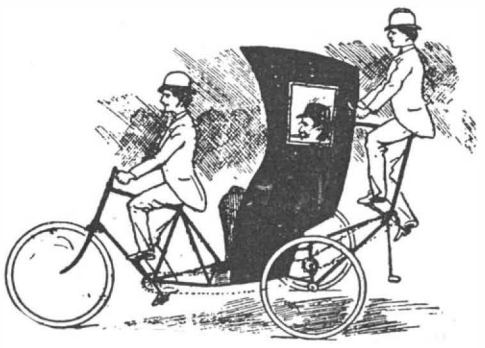
The note of this bird resembles "pon-ka-pog, pon-ka-pog," or, as described by some, the bubbling of a note up through water. Mr. Maynard thinks that our pond may readily have taken its name from the note of the bittern. How the bird has been able to produce such a note has always been a puzzle to naturalists. A short time ago, Mr. Bradford Torrey, the writer of so many charming bird sketches, and Prof. Faxon, seeing a bittern in Concord, watched him, and came to the apparently ridiculous conclusion that the bird sucked the air. In proof or disproof of this supposition, Mr. Maynard sought out the bittern and, on making an examination, found that these gentlemen were right. The bird was fitted with a peculiar muscular arrangement of the throat which serves exactly this end, the sucking in of air and the production of a note by its expulsion. The throat is flexible and may be greatly distended, being, when filled with air, some six inches in diameter. A muscular compressor prevents the air from entering the stomach of the bird, and two muscles in the lower mandible of the bird, together with the tongue, form an airtight valve at the mouth, which, being slightly relaxed, allows the air to bubble forth, making in its course two impacts against different parts of the bird's bill. This explains very satisfactorily the curious note.

A few words about methods of communication in birds followed. Mr. Maynard is satisfied that they can communicate by sound. He had at one time a tame crow, which had never learned crow language, and, when liberated among the birds that ought to have been his friends, was always attacked and obliged to seek the protection of his master.

Following this came some considerations of the flight of birds. The most interesting feature of this was the comparison of the breast bones of different birds. Those birds which attain very high rates of speed and which from necessity must suddenly swerve in their course have a re-enforcing mechanism, permitting them to withstand that sudden pressure of the air which is of necessity resultant from their changes of direction. Some interesting facts were stated in the course of the discussion. The frigate bird, which is an exceedingly powerful flier, can ride out the fiercest West Indian hurricanes. The duck hawk is the swiftest bird known to naturalists. Ducks themselves have been known to make speed at the rate of one hundred and fifty miles per hour, but the duck hawk can overtake ducks at maximum speed with such superior velocity as to make a great shock when striking its prey, while its flight at such times is so rapid as to elude the eye.

A CYCLE CAB.

Lately there has appeared in London a new vehicle in the shape of a cycle cab, of which we give a sketch. The driver in front works pedals and steers, while a footman, mounted behind, also assists the propulsion, as shown. Horses are at a discount wherever this vehicle prevails.



A CYCLE CAB.

Coating Aluminum with Other Metals.

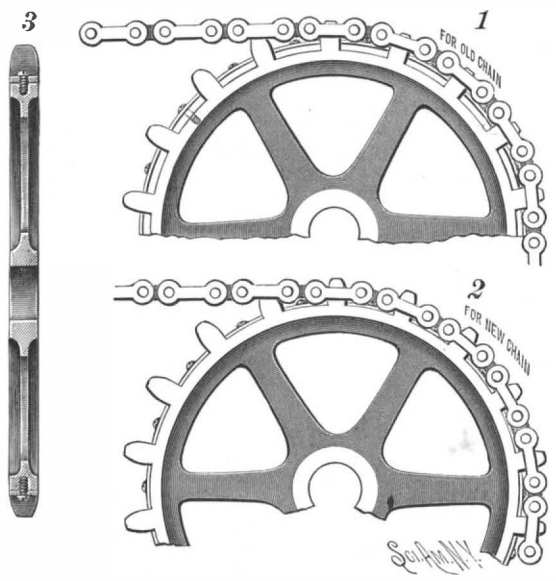
The processes ordinarily used for covering metals with zinc, tin, and lead have not, up to the present, appeared to be applicable to aluminum. When a plate of aluminum, mechanically or chemically cleaned, is immersed in melted tin, zinc, or lead, these metals slide over the surface of the aluminum without alloying therewith.

Mr. Oliven has found that, in order to fix the above-named metals, it suffices to submit the surface of the aluminum to a vigorous brushing in the metallic bath. For this purpose a steel brush or any other analogous instrument may be used. Under such circumstances, the aluminum becomes covered with a regular layer of the molten metal.

The want of success of the operation was due, it appears, not to the want of affinity of the aluminum for the metals in question, but to the immediate formation, in contact with the air, of a thin stratum of oxide of aluminum, which friction removes.—Le Genie Civil.

A SPROCKET WHEEL IMPROVEMENT.

This illustration represents a simple means of causing the sprocket chains of bicycles to fit the wheel at all times, no matter how much the chain may be stretched. A patent has been allowed upon this improvement to Messrs. P. D. Murphy and Edward Kolb, of No. 75 Main St., Lockport, N. Y. When a chain does not fit, on account of its stretch and the wear of the teeth, one has only to place under each of the plates which separate the teeth, the required thickness of paper, soft metal, or any other material. Fig. 1 represents such placing of packing on an old wheel, which is not needed on a new wheel, as shown in Fig. 2. The filling also deadens the rattle of a wheel and does not add appreciably to its weight. With this improvement the life of sprocket chains may be greatly increased, and the chains caused to fit the wheel until entirely worn out.



MURPHY & KOLB'S IMPROVEMENT IN SPROCKET WHEELS FOR BICYCLES.

The Torpedo.

A naval officer writes as follows in a recent number of Engineering:

The torpedo is essentially an immoral weapon, depending mainly for success upon secrecy, subterfuge, and deception. It was offered to our grandfathers in its first crude form as a fixed submarine explosive, but it was declined with thanks, or rather with scorn, as being unworthy of honorable combatants. Our morals are more elastic; and although it may be doubted whether the locomotive torpedo will have a governing influence in any fair stand-up fight of the future, it must be regretfully acknowledged that its moral—or rather immoral—effect will be considerable; and when accompanied by its proper handmaidens—secrecy, subterfuge, and deception—it may prove very troublesome.

Vessels will endeavor to approach under false colors, fire their deadly missile and run. The use of false colors has always been recognized as perfectly fair for reconnoitering purposes, and so long as ships did not fight under them. But now the true colors and the torpedo will be exhibited at the same moment, with awkward results. Hence it will behoove men-of-war at sea to be extremely shy of allowing any ship to approach within torpedo range, and they will do well to fire at everything that attempts to do so, until they are quite satisfied as to her identity and intentions.

The records of the Chile-Peruvian war afford us numerous instances of the diabolical use of various sorts of torpedoes during that conflict; and although European nations may not descend to such cruel and useless methods of destruction as were then employed, yet it seems very probable that torpedo warfare will lead to the terrible cry of "No quarter." It is difficult to see how it will be possible to give quarter to an enemy's torpedo boat caught at sea. Her success depends upon the tactics of the stealthy midnight murderer; and if caught in the daylight, she and all on board of her must be destroyed like vermin, surrender or no surrender.

As an illustration of this point, let us imagine that a group of six torpedo boats (they will probably act in groups) comes out from a hostile port, and attacks the ships at anchor in one of our harbors in the middle of the night, with the deliberate intention of sending as many ships as possible to the bottom, with all hands. The attack may or may not be successful, but in any case the boats will endeavor to get clear of the land, and if possible to regain their own port before daylight. Supposing, however, that they are so unfortunate as to fall in with one of our cruisers, and that in consequence of the weather being rough the cruiser is able to overhaul them. The last of the flying group will come first within effective gun range, and will doubtless surrender. Is the cruiser to stop and capture her, and allow the other five to escape and attack again to-morrow night? Such a course would be ridiculous, and she would have no option but to sink as many as possible of them without stopping to pick up the crews. This, no doubt, would lead to reprisals and counter-reprisals; and the end thereof is not apparent, save that the advent of the torpedo is not likely to help in humanizing naval warfare.

The Panama Canal.

The new Panama Canal Company was legally constituted at the meeting of shareholders held on October 20. MM. Baillet, Brolemann, Carraby, Chanove, Jonquieres, Lebegue, Ramet, St. Puentin, and Souchin were appointed administrators for six years, while MM. Barbier, Lemoine, and Fougen were named commissaries. Before closing the sitting, M. Lemarquis, the legal representative of the old bondholders, who presided, announced that a cablegram would be at once sent to M. Mancini, at Bogota, who would on its reception announce the constitution of the new company to the Colombian foreign minister, and that on October 21, 800 workmen would resume the so long abandoned work of the Culebra cutting. Though the list of administrators proposed by M. Lemarquis was adopted unaltered by an overwhelming majority of the shareholders, the meeting was very tumultuous. M. Thiebaud protested against the constitution of the new company, and declared that the proposed new administrators were the representatives of the men who had ruined the old Panama Company. The proposed new administrators represented MM. Eiffel, who subscribed ten million francs; Hugo Oberndoerffer, who subscribed three million five hundred thousand francs; Buno Varilla, who subscribed two million two hundred thousand francs; the administrators of the old company, who subscribed eight million francs; and the credit establishment, which subscribed ten million francs. In all nearly thirty-four million francs or not quite $7,000,000. With such persons at the head of the enterprise, it would be useless to hope the public would subscribe the remaining five hundred million francs required to complete the canal. M. Thiebaud's remarks were received rather coldly, and did not prevent the list of administrators prepared by M. Lemarquis from being adopted almost unanimously.

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Progress of the Phonograph.

A new sort of phonograph, invented by M. Koitzow, is described in the Revue Industrielle. Like all phonographs, the new machine is extremely simple. As in the Edison phonograph, a cylinder is used mounted in journals, and actuated by clockwork, but, instead of the wax covering of the Edison phonograph, M. Koitzow uses a hard kind of soap, cast in brass moulds. The soap has the advantage of retaining the impression longer than wax, and of not being subject to softening in hot weather. The sound to be impressed on the cylinder is recorded by a sort of ear trumpet, of hard rubber, and the impression is reconverted into sound by means of a lever with arms of unequal length, the short arm of which carries a point, in contact with the cylinder, while the other is attached to the membrane, the vibrations of which reproduce the sound. The soap cylinders last a long time. When the surface is covered with impressions, it may be washed off, and a fresh surface exposed. The impression need not be more than a thousandth of an inch in depth, so that one cylinder can be used to receive and transmit two hundred and fifty thousand words.

For many reasons, says the American Architect, it is to be desired that the phonograph should be developed into an instrument of practical utility, and any improvement is to be welcomed that will make it so. To say nothing of the moral effect that would be produced on people by having their own hasty words preserved and repeated to them, by the unerring cylinder, such a machine would be of great use in business. Some very rich men keep a stenographer concealed behind a screen in their offices, within hearing of what may be said to them, or what they may say in reply; and their conversations with strangers are reported and the notes preserved, for use in case of attempts to pervert such conversations for blackmailing purposes. Where it is inconvenient to employ a special stenographer, a good and silently-acting phonograph would make an excellent substitute, and its testimony might, in many cases, effectively frustrate the schemes of knaves. In fact, so dramatic might be the effect of the unexpected reproduction, in court, of a dialogue which one of the parties thought had taken place without witnesses, in the trial, perhaps, of a probate case, or of an action for breach of promise of marriage, or for some great and well-concealed fraud, that we have often wondered why some playwright did not introduce a phonograph in the most exciting scene of a realistic drama. It would not be easy to imagine an effect more novel and absorbing than that which might be secured by bringing the wily villain of the piece triumphantly to the last act, showing him there victorious and exultant in the middle of his fellow rascals, while unfortunate Virtue sobbed in the background, and, just as wo had nearly overwhelmed the audience, having the junior counsel for the defendant (in love with the oppressed heroine) arrive with a little box under his arm, and elicit from it, by turning the crank, a series of buzzings and squawks, on hearing which the villain should turn pale, pull from his pocket bundles of stocks, bonds, "title deeds" and so on, fling them at the heroine's feet, and seek safety in flight with his companions, only to be caught and dragged cursing back by the police, while the good people joined hands all around, uttering, as the curtain fell, the inarticulate murmurs expressive of virtuous joy.

Carborundum Electric Light Carbons.

Many efforts have been made, says the Electrical Engineer, to improve the quality of illuminating carbons, for the purpose of lengthening the life of the filaments, rods, or points, and also to produce a combination of carbon with other substances that would give more light for the electrical energy consumed. Many combinations of materials have been made, both in the mass of the filament, rod, or point, and in the coating of the mass. The main object of inventors has always been to produce a carbon containing a material having an excessively high fusing point and equally difficult of oxidation, and at the same time having a high luminescent value.

Mr. E. G. Acheson, well known as the inventor of carborundum, has recently produced a carbon in which he claims to have covered these points. He takes pure carbon and carbide of silicon (carborundum), reduces both to fine powder and mixes them in the proportions of nine parts of the former to one of the latter, together with tar or any other good binding material. The mixture is then baked and moulded into the proper form for use.

In order to get the full and complete effect of the illuminating qualities of the carbide of silicon more distinctly separated from that of the carbon, the ordinary cored carbon rod or point is used and the core is filled with the carbide of silicon, either alone or with a binding agent.

For the filaments of incandescent lamps, the carbide of silicon in a very fine powder is mixed with and suspended in the oil used in the oil bath, for the treatment and building up of the carbons; and in the process of depositing the carbon from the oil bath on to the filament, the fine particles of carbide of silicon become fixed to the filament simultaneously with the deposit of carbon.

As carborundum is formed at a temperature approximately that of the electric arc, it is necessarily free from all volatile matters and eminently fitted (as the result of having already existed at these high temperatures) for the light-giving body. It has also been demonstrated that it resists oxidation to a greater extent than any other known material, having resisted such chemical action when highly heated and exposed to a stream of oxygen gas. Associated with these two essential qualifications of infusibility and non-oxidizability, is a third equally valuable one, that of luminescence, as it is claimed to produce a greater amount of light for the electrical energy consumed than any illuminating body heretofore used.

Gas for Fuel.

At the recent meeting of the Ohio Gas Light Association, Dr. Donald McDonald read a paper with the above title, giving an interesting comparison of the relative value of gas and coal for heating purposes, and of the proper manner of using gas for house heating. The following are extracts:

For cooking or for occasional fires gas can be used with economy at $1 per 1,000 feet. With a good gas at 50 cents per 1,000 feet, all sorts of cooking can be done with it, and the heating of parlors and dining rooms, and those bedrooms which are not used as sitting rooms during the day, can be done at a cost so little greater than the cost of coal that people will put up with it on account of the greater convenience of gas. At 35 cents per 1,000 feet for a good gas containing (say) 700 heat units, gas can be used as a heating agent all over a residence, and the cost will not exceed that of anthracite coal at $8 a ton or soft coal at $3.50 a ton, after allowance is made for kindling and labor.

If gas at 50 cents per 1,000 feet is burned in a good gas stove, in a tolerably close room, without any chimney draught, the products of combustion escaping into the room, the amount of gas required to heat the room will be so small that coal will not compete with it in the price. The room, however, if it is small and close, will become unfit for habitation, owing to the consumption of the oxygen of the air, and the formation of carbonic acid and watery vapor.

One hundred cubic feet of natural gas weighs 4,287 pounds. It is composed of 1,072 pounds of hydrogen and 3,215 pounds of carbon; it requires for its perfect combustion 969·3 cubic feet of air, weighing 74,561 pounds. It makes in burning 9,648 pounds of steam and 11,788 pounds of carbonic acid, equal to 100. It produces 94,593 heat units when the steam is not condensed. The total products of combustion are, therefore: Steam, 9,648; carbonic acid, 11,788; nitrogen, 57,412; total, 78,848 pounds. If these products of combustion escape at a temperature of 600°, they carry off with them 12,712 heat units, or about 14 per cent of all the heat produced by the fire. If they escape at 300°, they carry off less than 7 per cent. Suppose, however, that for any reason twice as much air as is necessary to combustion passes through the fire, and escapes up the chimney, along with these products of combustion; at a temperature of 600°, we would then have a loss of heat units equal to 23,332 heat units, or about 26 per cent of all the heat produced by the fire. If three times as much air as is necessary for combustion is admitted and allowed to escape at 600°, then the loss is 40 per cent.

It must be remembered, however, that with a wide open chimney and a strong draught, not only is the volume of air which escapes up the chimney increased, but also the temperature is apt to be high. We find, therefore, that if a fire takes in five times as much air as is necessary, and that it escapes at a temperature of 800°, then the loss will amount to 92 per cent of all the heat produced by the fire.

A room 16 × 16 × 12 feet contains about 3,000 cubic feet and will require 2,177 heat units in order to bring its temperature up from 30° to 70°. If the combustion were perfect, and there were no other loss than that due to the actual products of combustion escaping at 300° F., such a room should be heated from 30° up to 70° with the consumption of 3 feet of gas per hour; or, assuming that the air is changed three times per hour, and that there is no loss through the walls or windows, 9 feet of gas per hour would keep such a room warm.

The next question, and one equally important, is, At how low a price can gas companies afford to sell a first rate gas? There is no doubt but that a natural gas company can afford to manufacture artificial gas to supply the deficiencies during cold weather, and sell the mixture for 35 cents per 1,000 feet, and even much cheaper. The question as to what illuminating gas companies can do in this line is not one so easily settled. Assuming, however, that none of the expenses of the illuminating gas company would be charged to the cost of furnishing the fuel gas, except the interest and repairs on the additional apparatus, and the cost of the additional fuel and labor necessary to make the extra amount of gas, then I believe that a very fair profit would be found in selling 18 candle power gas, to be used as fuel, at 40 cents per 1,000 feet. If this were done, and the attention of the public properly called to the advantages of this fuel, I believe that I am not a false prophet when I say that the time would come when the receipts from gas sold for fuel would greatly exceed the receipts from gas sold for light.

With regard to the question of how this gas is to be made, I can only say that my experience in the line of making artificial gas is not long enough to entitle my opinion to any great weight on the subject. It is evident, however, that what is wanted is not cubic feet, but heat units, and that in order to get these heat units at a reasonable cost, we must get them from substances in which the heat exists at a reasonable cost. For instance, if gas containing 700 heat units per foot is to be sold at 40 cents per 1,000 feet, then the cost of 1,000,000 heat units is 57·14 cents. Now then, if this gas is made entirely from naphtha distillate at 2½ cents per gallon, then each 1,000,000 heat units in the gas would cost the company, exclusive of labor and all other items, about 18 cents, provided all the heat in the naphtha could be got into the gas. As a matter of fact, however, only a percentage of the heat existing in the naphtha can be recovered in the gas, and I shall assume that this percentage is 60. On this basis the heat units in the naphtha gas would cost the company for gas making material alone 30 cents per 1,000,000 heat units. With coke at $3.50 a ton, rating it at 14,000 heat units per pound, and assuming that the same percentage will be recovered, the gas would cost the company 19 cents per 1,000,000 heat units. With soft coal at $1.50 a ton, 14,000 heat units per pound, and the same assumption as to the percentage of heat to be recovered in the gas, we would have a cost to the company of 8·9 cents per 1,000,000 heat units. These figures seem to force the conclusion that when gas is made at a price low enough to be sold as a general heating agent, it will be made with soft coal, and may or may not be enriched with crude oil or naphtha.

The author then proceeds to describe the plant in use at Louisville, in which a water gas plant is combined with the retorts of a coal gas plant. This apparatus was erected by the National Heat and Power Company, of Philadelphia, and experience with it shows a consumption of material per 1,000 feet of gas about as follows: Gas coal, 35 pounds; boiler coal, 13 pounds; coke, 10 pounds; oil, 2½ gallons. The gas made is a good quality of illuminating gas, and rich enough in heat units to allow it to be mixed with natural gas in almost any proportion.

Cylindrical Cotton Bales.

The shipment of cotton, compressed by a new method, made from Waco, Texas, arrived in Boston recently. It was the largest single car load of baled cotton that has ever come into Boston, and consisted of one hundred and twelve bales. They weighed 53,000 pounds, and it is stated that fifteen bales more could have been squeezed into the car. The average capacity of a box car is 50,000 pounds, so that this load of cotton overrun the standard by 3,000 pounds, and is estimated to be 30 per cent more than is put in the same space when the bales are packed in the old-fashioned way. According to the Boston Journal of Commerce, the increased capacity is produced by what is termed the Bessonnette compress, a new method of baling cotton recently patented. By this method the bales are made round. They are about four feet two inches in length and two feet in diameter, with an average weight of about 500 pounds, and are intended to take the place of the old-time box bales. By this method the cotton is taken from the condenser and is rolled into a cylindrical bale, being compressed as it rolled up. The air is thus forced out of the thin layer or mat, as it comes out of the condenser, and is kept out by being rolled between two ponderous rollers of several tons each. The inventor claims many advantages in cost and protection of the fiber, and cotton men think this system of round baling will, in a great measure, revolutionize the exporting business. While seventy-five or eighty of the old box bales will completely fill a car, it is claimed that one hundred and fifteen or more of the round can be stuffed into a car. The car came in over the New York and New England Railroad, and there were a number of cotton and shipping men to inspect the novelty, as it was the first car load of the kind ever shipped North. Of course the increased capacity must be gained from the round bale permitting a denser compression, so as to give a much greater weight, foot for foot, to compensate for the loss in storage capacity possessed by the square bale.

Maxim's Flying Machine.

Mr. Hiram S. Maxim gives in the National—an English magazine—a description of his experiments on flying by means of an aeroplane. His flying machine, when finished and loaded with water, fuel, and three men, weighed nearly 8,000 pounds. The actual horse power developed on the screws was 363 horse power, with a screw thrust of about 2,000 pounds. The total width of the machine was over 200 feet. On running the machine at 30 miles an hour, very little load remained on the track, and at 36 miles an hour the whole machine was completely lifted.

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THE MANUFACTURE OF BURGLAR PROOF VAULTS.

The manufacture of burglar proof vaults has, like many other industries, emerged from the stone into the steel age. In earlier times the stone and brick walled vault was considered safe. To-day the improved appliances of the burglar can only be resisted by steel. In the present issue we illustrate some of the processes of the manufacture of burglar proof vaults, of which several very fine examples have recently been erected in this city and Boston. The walls of the vault proper are built of composite plates formed of alternate layers of soft steel or iron and of the hardest steel. In the cut, Fig. 2, the section of a plate is shown. This is a five-ply plate, with two steel layers and three iron ones. While various dimensions may be chosen, these plates are generally used of one-half inch thickness, except the outside one, which is one inch thick. The walls are built up of such plates, laid so as to break joints, and screwed together with flat-headed top bolts. Even the bolts are made of the same composite metal, twisted around. The small cut shows one of these bolts with the side cut away so as to show the steel embedded in the iron and twisted helix fashion.

When the plates are received their edges are planed and they are drilled and tapped for the screw bolts. Each bolt goes through one plate, its head entering a countersunk hole and lying flush with the plate and screwing into a tapped hole in the next plate. The drilling we show as executed by the Moffet steam drill. A small rotary steam engine is mounted over the drill and steam is conveyed to it by a hose. As it turns it works the drill by gearing. In Fig. 3 is shown a workman drilling one of the plates. The outside plate has blind holes only, none going through it, and these holes are all tapped. In the building the first layer of plates is bolted to it, the next layer to them, and so on until any desired thickness is obtained.

The entire vault is built up in the factory, every plate having its own place. Next the whole is dismantled and the plates are hardened by heating to redness and immersion in water. We have already (see SCIENTIFIC AMERICAN, July 21, 1894) illustrated this process as carried out at the Cornell Iron Works. The plates are heated on the water edge and immersed in the river.

This often entails warping, and accordingly many of the plates have to be rolled cold to straighten them and some have to be polished off to a flat surface with an emery polisher, shown in Fig. 4. The workman cuts down any high portions of the plate until it is adapted to bed well against its neighbor. The edges have often to be ground off, the emery wheel buffer shown in Fig. 6 being employed.

The doors are built up in exactly the same manner. Their joints or edges are of very complicated cross section to prevent wedging, as shown in Fig. 1. Here three tongues are shown entering grooves in the jamb to afford additional protection against yielding to lateral wedging. These joints have to be constructed with great exactness, and the surfaces are all hand filed and polished. The fit alone makes them almost air tight, and list packing is also employed to insure a fit. In Fig. 5 is shown one of the great doors mounted in its vestibule; while the process of hand filing the edges is also shown.

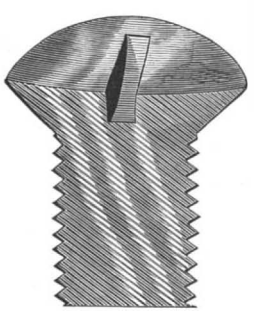
Doors fitted as described make it impossible for the burglar to introduce gas, or a liquid, or finely divided explosive for blowing up the safe.

The inner face of the door has much of the machinery of the locks exposed. Over it is bolted a cover of heavy plate glass. In the cuts Figs. 5 and 7 the bolts for this cover are shown projecting around the edges. In the cut on this page the interior of a finished door is shown.

As a single door may weigh from four to six tons, ball-bearing hinges are employed to enable a man to close and open it. Time locks are used, which are set at night to run a given number of hours. Until the time assigned has expired, it is impossible to open the safe.

These vaults are often very large. In this city the National Safe Deposit Company has one in the Mutual Insurance building which has an area of fifteen feet six inches by forty-three feet ten inches, and which is nine feet high. Nearly 400 tons of steel are used in its construction. It has two entrances, the doors of which are controlled as regards opening by three clocks on each one. All the clocks are kept running, and any one is sufficient to release the time locks on its own door. Thus if five clocks out of the six were to break down, the locks on one of the doors would still be released when the appointed time came.

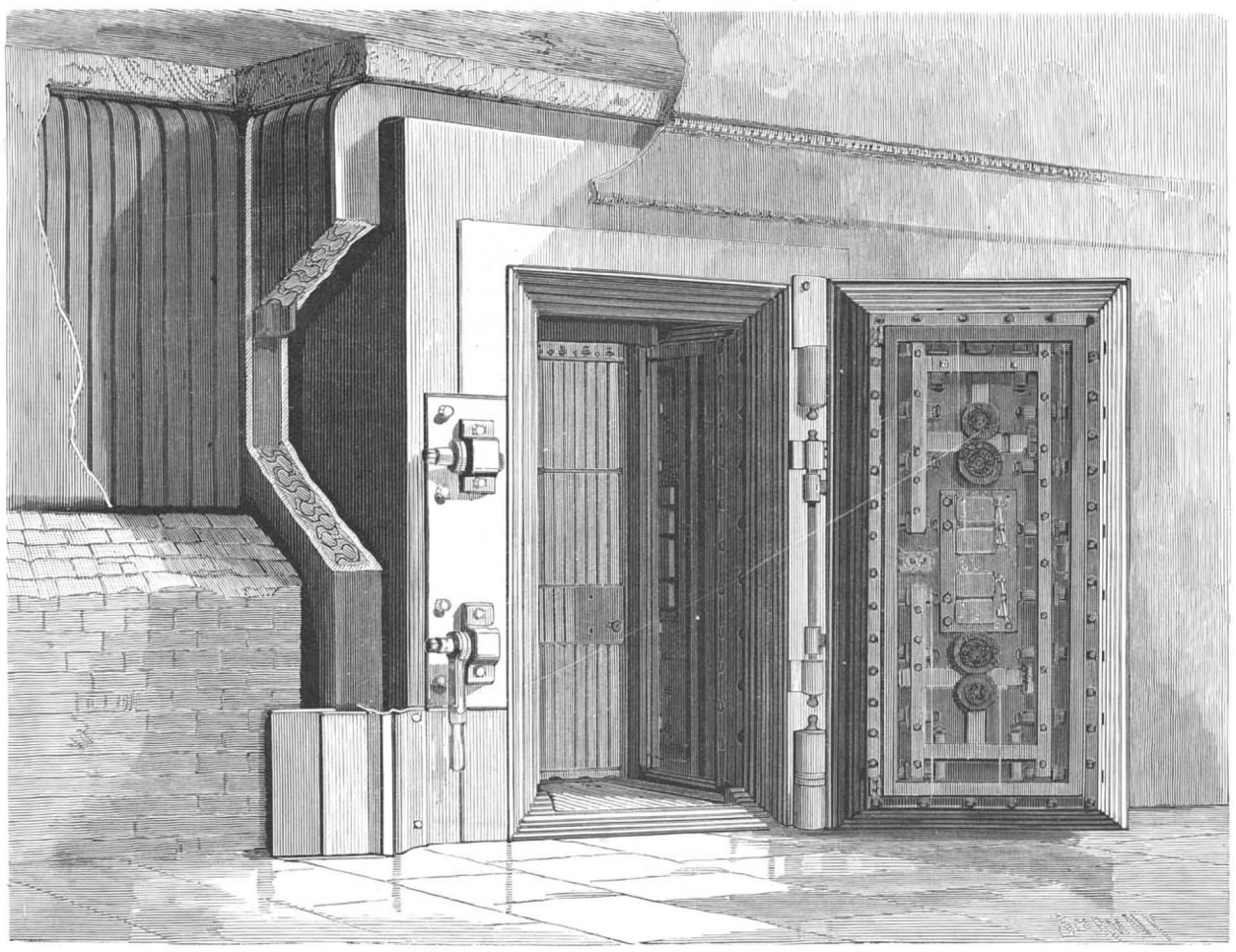
A ONE-QUARTER HORSE POWER GAS ENGINE—SIZE 5 X 13 INCHES.



COMPOSITE STEEL BOLT.

A further protection is sometimes given to the vaults by a species of cage made of special section railroad iron, which is built up around the steel structure. Our cut on this page shows this element in its relation to the rest of the structure. The rails are closely nested, and when in place are bedded in or run with Portland cement.

The general arrangement of the vaults involves their exposure on all sides to the watchman's patrol. No part must be against a wall, as this would give burglars a chance to penetrate through the wall and work in concealment upon the sides of the vault. But even if a burglar were given free scope, it is doubtful if he could, within the few hours open to his operations, do much in the way of perforating the compound plates. The hard steel is almost undrillable, and if sledging or ramming were resorted to, while the hard metal might crack, it would remain so firmly bedded between the layers of soft steel that it would still resist the drill. The interior of these large vaults may be fitted up in any desired way. They may contain a quantity of smaller safes subdivided in any desired way. Electric light may be used for lighting and as an adjunct to safety. A steam pipe may be arranged over the doors outside the vault by means of which a volume of steam may be discharged in a case of a riot which would prevent any one from being able to even approach the vault. All these appliances may be seen in the National Safe Deposit Company's vault already alluded to, and which was constructed by J. B. & J. M. Cornell, of this city. In it are embodied all the features of construction described here.



SAFE DOOR AND PROTECTIVE CAGE OF RAILS.

A GAS ENGINE FOR SMALL POWER.

The usefulness and desirability of small motors is generally admitted, but the disproportionate cost of such motors has been an obstacle to their more general introduction. Many mechanics and amateurs have constructed small motors of various kinds with greater or less success, but when they have attempted to design and construct a gas engine (which is undoubtedly one of the best of small motors), they have generally failed, because it is no simple matter to design a successful gas engine. It is only after a long and expensive series of experiments that success in this line is attained.

Messrs. A. F. Weed & Company, of 106 and 108 Liberty Street, New York City, have perfected a small gas engine of about one-quarter horse power, weighing 70 pounds, and occupying a floor space of 5 by 13 inches, and offer for sale not only the engines, but the castings of all the parts and all materials and drawings necessary for building a complete working engine, so that any machinist or wideawake amateur can with little expense and a not very large amount of labor make the engine for his own use.

The engine will meet the requirements of those needing a light power. It is instantly started, and is simple and manageable.

The Weed gas engine belongs to the class of engines igniting at constant volume with previous compression.

The working cycle is divided into four parts, in which the engine makes two revolutions. During the first complete revolution of the engine, the cylinder acts as an air pump.

As the piston moves forward, gas and air of the required mixture are admitted through the automatic inlet valve. When the piston has reached the forward end of the cylinder, the inlet valve closes, and as the piston returns to the back end of the cylinder, the charge of gas and air is compressed to about one-third its original volume.

At the beginning of the second revolution, the compressed charge of gas and air is ignited by an electric spark, which causes the explosion and forces the piston forward until it reaches the front end of the cylinder, at which time the exhaust valve is opened, and during the return stroke the burned gases are discharged through the exhaust pipe.

This engine is what amateur mechanics have long looked for.

To Preserve Colors in Dried Flowers.

The discoloration of many flowers upon drying may be attributed to the presence in the atmosphere of ammonia. To counteract its injurious action Nienhaus (Schweiz. Wochen. f. Chem. u. Phar.) has hit upon the idea of pressing his plants between paper previously saturated with a 1 per cent oxalic acid solution and dried. In this manner he has obtained most beautiful specimens of dried flowers of papaverrhœas, one of the most difficult flowers to preserve unchanged. This idea may possibly be extended.

OVER seven thousand men it is said have been sheltered at one time beneath the branches of one banyan tree.

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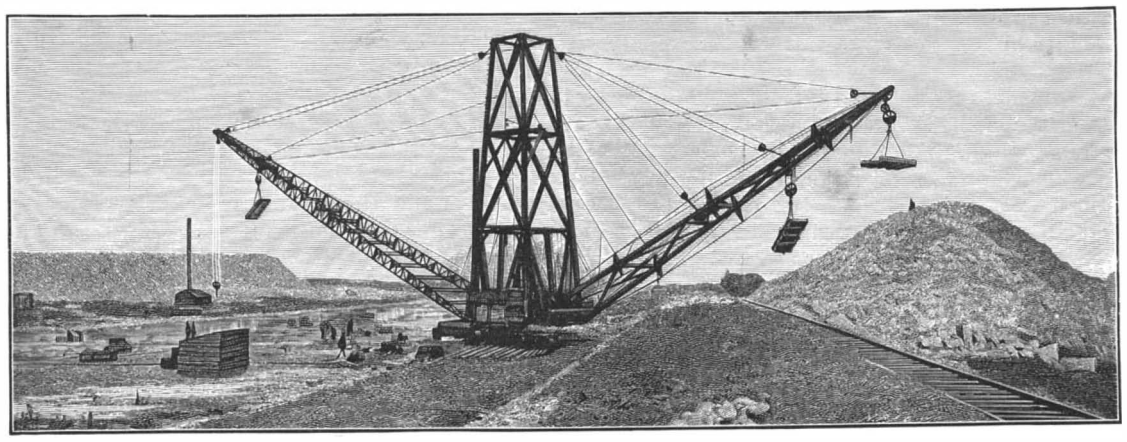
TWO ARM DERRICK—CHICAGO DRAINAGE CANAL.

Our engraving illustrates one of the high power two armed derricks now at work on section 14 of the great Drainage Canal of Chicago. The great radius of the arms facilitates the removal and deposit of the debris in a most economical manner.

The two arms of each derrick are of different lengths, one being long enough to handle skips clear across the channel and the other one shorter and equipped for handling them on the side nearest the point where the derrick stands. Each arm carries two skips, and while one is over the ditch picking up two skips the other is over the spoil bank dumping two.



TWO ARM DERRICK—CHICAGO DRAINAGE CANAL.

The Highest Bridge.

The highest bridge of any kind in the world is said to be the Loe River viaduct, on the Antofagasta Railway, in Bolivia, South America. The place where this highest railway structure has been erected is over the Melo rapids in the Upper Andes, and between the two sides of a canon, which is situated 10,000 ft. above the level of the Pacific. Counting from the surface of the stream to the level of the rails, this celebrated bridge is exactly 636½ ft. in height. The length of the principal span is 80 ft., and the distance between abutments (total length of bridge) is 802 ft. The largest column is 314 ft. 2 in. long, and the batter of the pier, what is known to bridge builders as "one in three." The gauge of the road is 2 ft. 6 in., and trains cross the bridge at a speed of 30 miles an hour.

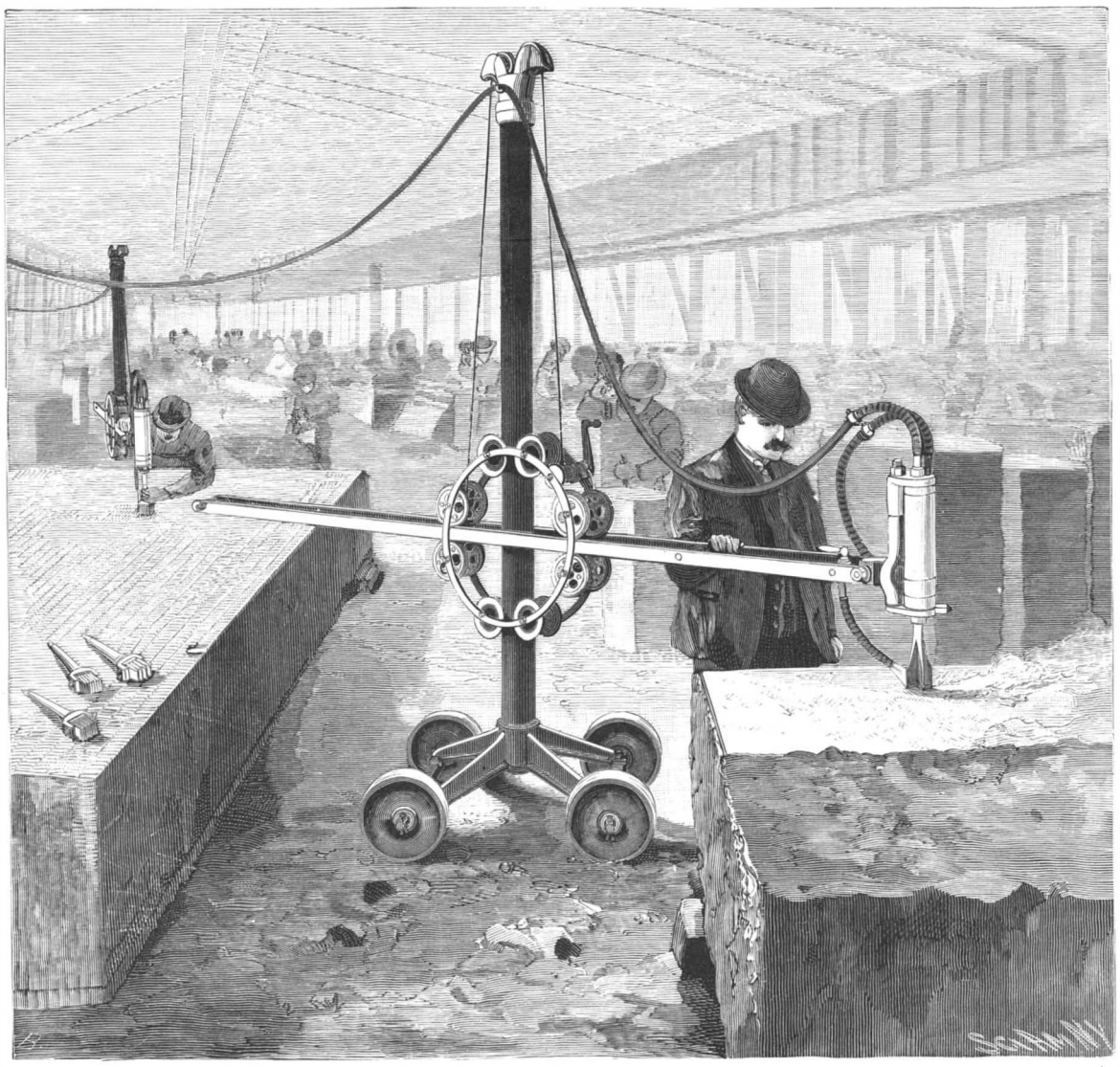
PORTABLE STONE DRESSING MACHINE OF THE AMERICAN PNEUMATIC TOOL COMPANY.

Some years ago we illustrated and described the MacCoy pneumatic tool, of the American Pneumatic Tool Company, of this city. At that time it was attracting much interest from a scientific standpoint, as well as from its extensive application in industrial work. Its uses have been varied and extended, and the stone worker and boiler maker both find it an indispensable adjunct in carrying out their work. The tool proper is virtually a little steam engine, which of course can be worked by compressed air. Within a cylinder is a piston which by the action of the steam or compressed air is made to reciprocate back and forth with very great rapidity. On the up stroke it cushions against steam or air, but on the down stroke it strikes against the head of a cutting bit, chisel or other appliance introduced into a socket in the lower end, and pressed upward by a spring. The chisel or other tool carried by it will receive several thousand blows in the course of a minute.

The distinctive peculiarity of the mechanism is that the cutting tool proper is not moved, but can be held constantly against the work while subject to the impacts of the reciprocating piston. On account of this distinctive action the pneumatic tool can be held in the hand against a surface and will operate thereon without any other abutment. It is startling to see great flakes of stone pared off by its action and stubborn material yielding to it as readily as wood to the action of a hatchet. A two inch chisel will cut flakes half as large as the hand in brown stone. For delicate work it is unexcelled; marble can be carved by it, the material shaping itself under the action of the tool, almost as if the design were being modeled from clay.

In our present issue we illustrate one of the last improvements introduced by the American Pneumatic Tool Company, of 844 Washington Street, New York City, the new portable stone dressing machine. This machine is designed for use on the hardest granite for working it to a surface. It takes the stone rough pointed, about an inch above the final surface level. It quickly brings the granite to a readiness for a polish by the use of a cross chisel, and for 4, 6, 8, 10 and 12 cut surface, bush hammers corresponding to hand hammers are used.

Upon a base carried on wheels, so as to be capable of movement when it is desired, is mounted a vertical hollow column. A carriage with guide rollers is arranged to move up and down this column, and this carriage sustains a horizontal carrier bar, which can slide freely back and forth, to one of whose ends the pneumatic tool is fastened. A partial counterpoise for the weight of the carriage, carrier bar and tool moves up and down within the column and is attached by wire ropes to the carriage, and for adjusting the play of the counterpoise to provide for different elevations of the carrier bar, there is a windlass on the carriage. The carrier bar is double and runs on four pairs of rollers, and by sliding it in and out and swinging its end laterally, the tool can be moved in any desired direction in a horizontal plane. The action of the mechanism is obvious. The stone to be operated on is placed in about the position required to work it by hand; the stone dressing machine is moved to any convenient place near the stone (or the stone to the machine), the play of the counterpoise is adjusted for the height of the surface to be operated on, and the tool started. The hard granite at once succumbs, and in a very short space of time the surface begins to take shape, and in a few minutes a superficial foot can be dressed. The exhaust of the tool is caused to maintain a blast against the point of the tool to blow away the chips and dust.



PORTABLE STONE DRESSING MACHINE OF THE AMERICAN PNEUMATIC TOOL COMPANY.

In the foreground of the picture the machine is shown operating a cross chisel, while fine bushing is shown in progress in the background, the operator holding the tool in his hands so as to regulate its work.

Allowing for wages, repairs, and fuel, it is estimated that the machine can be run for a cent a minute. From actual operation of the machine it is found that six to ten minutes is a fair average for work upon one superficial foot, and a saving of thirty cents per foot over hand labor on the basis of Quincy prices is found to be effected. On the work of a single machine this is a daily saving of $18, an annual saving of over $5,000. Owing to the more uniform cutting of the machine, from ten to twenty cents a foot additional is saved in the polishing, and the blacksmithing also costs less. As the machine produces no stuns, the quality of the cut work is very superior.

Another most important point is that it combines the skill of the workman with the efficiency of machinery. The stone need not be level, for by setting the tool properly and by ordinary attention on the part of the workman, it can be brought to a perfect surface.

A New Emerald Mine.

Mr. Geo. F. Kunz, writing to the American Journal of Science, says: In July, 1894, a new locality of true emeralds was discovered by Mr. J. L. Rorison, miner of mica, and Mr. D. A. Bowman, on the Rorison property, near Bakersville, Mitchell County, N. C. Here, at an elevation of five thousand feet a. t., on Big Crab Tree Mountain, occurs a vein of pegmatite some five feet wide, with well defined walls, in mica schist. This vein carries a variety of minerals besides its component quartz and feldspar, among these being garnets; translucent, reddish, and black tourmalines, the latter abundant in slender crystals; white, yellow, and pale green beryls; and the emeralds. These latter are chiefly small, 1 to 10 mm. wide by 5 to 25 mm. long, but some have been found two or three times larger than the larger size named. They are perfect hexagonal prisms, generally well terminated, and are clear and of good color, with some promise for gems. They very strikingly resemble the Norwegian emeralds from Arendal.

One vein outcrops for perhaps a hundred yards, with a north to south strike. The results thus far obtained are only from about five feet depth of working, so that much more may be looked for as the vein is developed.

The locality is fourteen miles south of Bakersville, and about the same distance from Mitchell's Peak, a little north of the crest of the Blue Ridge. It is some fifty miles west of the emerald locality at Stony Point, Alexander County, N. C., described by William Hidden, in 1881, in a pamphlet privately printed at New York, and in the Transactions of the New York Academy of Sciences, 1882, pp. 101–105, as also by the writer in "Gems and Precious Stones of North America," New York, 1888, p. 91.

I am indebted to Messrs. Rorison and Bowman for the information contained in this paper and for the privilege of examining the specimens found by them.

Lick Observatory.

In reply to a correspondent who asked, In a large observatory, such as the Lick, how are expenses met? Popular Astronomy replies as follows:

Of the $700,000 left by Mr. James Lick, for the erection of the Lick Observatory, more than $575,000 was used in preparing the site, erecting the buildings, and securing the astronomical instruments for the observatory. So that of the large gift bestowed, less than $125,000 remained for the support of the observatory after its completion. The observatory belongs to the University of the State of California, and we understand that the State pays all running expenses and has control of endowment funds through university officers. Professor Holden estimates the annual expenses of the observatory at $20,000.

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The Atmosphere and Climate of Mars.

Dr W. H. Pickering has given in Astronomy and Astro-Physics a translation of Schiaparelli's latest views regarding Mars, as originally published in Natura ed Arte, from which we quote the following:

The polar snows of Mars prove in an incontrovertible manner that this planet, like the earth, is surrounded by an atmosphere capable of transporting vapor from one place to another. These snows are in fact precipitations of vapor, condensed by the cold, and carried with it successively. How carried with it, if not by atmospheric movement? The existence of an atmosphere charged with vapor has been confirmed also by spectroscopic observations, principally those of Vogel; according to which this atmosphere must be of a composition differing little from our own, and above all very rich in aqueous vapor. This is a fact of the highest importance, because from it we can rightly affirm with much probability that to water and to no other liquid is due the seas of Mars and its polar snows. When this conclusion is assured beyond all doubt, another one may be derived from it, of not less importance—that the temperature of the Arean climate, notwithstanding the greater distance of that planet from the sun, is of the same order as the temperature of the terrestrial one. Because, if it were true, as has been supposed by some investigators, that the temperature of Mars was on the average very low (from 50° to 60° below zero!) it would not be possible for water vapor to be an important element in the atmosphere of that planet, nor could water be an important factor in its physical changes; but would give place to carbonic acid, or to some other liquid whose freezing point was much lower.

The elements of the meteorology of Mars seem then to have a close analogy to those of the earth. But there are not lacking, as might be expected, causes of dissimilarity. From circumstances of the smallest moment, nature brings forth an infinite variety in its operations. Of the greatest influence must be the different arrangement of the seas and the continents upon Mars and upon the earth, regarding which, a glance at the map will say more than would be possible in many words. We have already emphasized the fact of the extraordinary periodical flood, which at every revolution of Mars inundates the northern polar region at the melting of the snow. Let us now add that this inundation is spread out to a great distance by means of a network of canals, perhaps constituting the principal mechanism (if not the only one) by which water (and with its organic life) may be diffused over the arid surface of the planet. Because on Mars it rains very rarely, or perhaps, even, it does not rain at all. And this is the proof.

Let us carry ourselves in imagination into celestial space, to a point so distant from the earth that we may embrace it all at a single glance. He would be greatly in error who had expected to see reproduced there, upon a great scale, the image of our continents with their gulfs and islands, and with the seas that surround them, which are seen upon our artificial globes. Then, without doubt, the known forms, or part of them, would be seen to appear under a vaporous veil, but a great part (perhaps one half) of the surface would be rendered invisible, by the immense fields of cloud, continually varying in density, in form and in extent. Such a hindrance, most frequent and continuous in the polar regions, would still impede nearly half the time the view of the temperate zones, distributing itself in capricious and ever-varying configurations. The seas of the torrid zone would be seen to be arranged in long parallel layers, corresponding to the zone of equatorial and tropical calms. For an observer placed upon the moon, the study of our geography would not be so simple an undertaking as one might at first imagine.

There is nothing of this sort in Mars. In every climate, and under every zone, its atmosphere is nearly perpetually clear, and sufficiently transparent to permit one to recognize at any moment whatever the contours of the seas and continents, and more than that, even the minor configurations. Not indeed that vapors of a certain degree of opacity are lacking, but they offer very little impediment to the study of the topography of the planet. Here and there we see appear from time to time a few whitish spots, changing their position and their form, rarely extending over a very wide area. They frequent by preference a few regions, such as the islands of the Mare Australe, and on the continents, the regions designated on the map with the names of Elysium and Tempe. Their brilliancy generally diminishes and disappears at the meridian hour of the place, and is re-enforced in the morning and evening, with very marked variations. It is possible that they may be layers of cloud, because the upper portions of terrestrial clouds, where they are illuminated by the sun, appear white. But various observations lead us to think that we are dealing rather with a thin veil of fog, instead of a true nimbus cloud, carrying storms and rain. Indeed it may be merely a temporary condensation of vapor, under the form of dew or hoar frost.

Accordingly, as far as we may be permitted to argue from the observed facts, the climate of Mars must resemble that of a clear day upon a high mountain. By day a very strong solar radiation, hardly mitigated at all by mist or vapor, by night a copious radiation from the soil toward celestial space, and because of that a very marked refrigeration. Hence a climate of extremes, and great changes of temperature from day to night, and from one season to another. And as on the earth, at altitudes of 5,000 and 6,000 meters (17,000 to 20,000 feet), the vapor of the atmosphere is condensed only into the solid form, producing those whitish masses of suspended crystals which we call cirrus clouds, so in the atmosphere of Mars it would be rarely possible (or would even be impossible) to find collections of cloud capable of producing rain of any consequence. The variation of the temperature from one season to another would be notably increased by their long duration, and thus we can understand the great freezing and melting of the snow, which is renewed in turn at the poles at each complete revolution of the planet around the sun.

As our chart demonstrates, in its general topography Mars does not present any analogy with the earth. A third of its surface is occupied by the great Mare Australe, which is strewn with many islands, and the continents are cut up by gulfs and ramifications of various forms. To the general water system belongs an entire series of small internal seas, of which the Hadriacum and the Tyrrhenum communicate with it by wide mouths, while the Cimmerium, the Sirenum and the Solis Lacus are connected with it only by means of narrow canals. We shall notice in the first four a parallel arrangement, which certainly is not accidental, as also not without reason is the corresponding position of the peninsulas of Ausonia, Hesperia and Atlantis. The color of the seas of Mars is generally brown, mixed with gray, but not always of equal intensity in all places, nor is it the same in the same place at all times. From an absolute black it may descend to a light gray or to an ash color. Such a diversity of colors may have its origin in various causes, and is not without analogy also upon the earth, where it is noted that the seas of the warm zone are usually much darker than those nearer the pole. The water of the Baltic, for example, has a light, muddy color that is not observed in the Mediterranean. And thus in the seas of Mars we see the color become darker when the sun approaches their zenith and summer begins to rule in that region.

All of the remainder of the planet, as far as the north pole, is occupied by the mass of the continents, in which, save in a few areas of relatively small extent, an orange color predominates, which sometimes reaches a dark red tint, and in others descends to yellow and white. The variety in this coloring is in part of meteorological origin, in part it may depend on the diverse nature of the soil, but upon its real cause it is not as yet possible to frame any very well grounded hypothesis.

Railroads in Africa.

Mr. H. M. Stanley, in an interview with a representative of the Exchange Telegraph Company, in regard to the situation in Uganda, said there was not room for two railways in the country, and, if the absolute need of a railway was felt by both England and Germany, it would be better for the two governments to combine in the enterprise than to construct two separate lines. The best thing would be for England to make the railway, and if the admirable "Lartigue" system were adopted instead of the old-fashioned earthwork and ballast railway adopted by the Germans in the 15 mile line they had already constructed, it would be possible, if the work were commenced three months from now, starting from Mombasa, to carry the line to Lake Victoria in about 18 months or two years at an expenditure of £1,000,000. The Lartigue system of railway was to be seen in operation on an experimental line eight miles in length between Listowel and Ballybunion in Ireland. The train runs upon three rails arranged triangularly, the top rail, which is the apex of the triangle, being several feet from the ground. With this system, if an accident happens to a train when at full speed, the train drops a few inches upon the ground, and very little damage is incurred, in addition to which the construction costs only about £1,500 a mile. This system was consequently far the best for pioneer railways such as that required in Uganda. All the plant would be manufactured in England, put up in sections and transported, which would greatly facilitate the speed of construction. In Africa, where labor cannot be got so easily as here, the expense of making earthworks is enormous.

The latest information he had received as to the progress of the Congo Railway was that it was being constructed at the rate of 200 meters a day, and this was due to the fact that for the Congo Railway the old style had been adopted, which was costing £8,000 a mile. Earthworks and ballast had been made for 40 miles, but of the actual Congo Railway only 32 miles had been constructed in four years. With the Lartigue system, from one to ten miles of line could be laid in a day. To-day the land through which the Uganda Railway would pass was valueless for all practical purposes, but the railway would open out 650 miles of new country to all kinds of enterprises, and at the end of the track there would be the shores of Lake Victoria, 12 miles in length, to feed the railway. The immediate customers of the line would, of course, be the British government in Uganda, the German authorities on Lake Victoria, the Congo state authorities to the west of Uganda, the Roman Catholic and Protestant missionaries of the lake regions, and the missionaries on Lake Tanganyika. To bring Lake Victoria and the surrounding country within five days', instead of three months', journey from the sea would give an enormous impetus to trading.

The Hungarian Flour Industry.

Consul Edward P. T. Hammond, Budapest, Austria-Hungary, writes as follows to the State Department: Hungary not only produces wheat enough to cover its own needs, but has a surplus production, enabling it to export wheat largely to neighboring Austria and to Germany and Switzerland, besides supplying its important milling industry, which exports large quantities of wheat flour to Austria, England, Germany and France. The Hugarian mills fully supply the home market and compete with American wheat flour in some of the foreign markets. The standard of living naturally differs with the different classes of the population, and as to these classes it again differs in wealthier or poorer districts. In the matter of eating and drinking there is hardly any difference between the mode of living of the wealthiest classes in this country and those of the Continental countries further west. It is only when we come to the vast host of less favored professional people, merchants, tradespeople, and employes of all kinds other than laborers inhabiting the cities and towns that we discover any substantial difference. These, comprising about one-tenth of the population, live chiefly on coffee and wheat rolls or bread for breakfast, and soup, boiled meats, vegetables and a dish of boiled dough, made of wheat flour of superior or inferior quality, according to the purse of the consumer, for dinner. Supper is a scantier meal, consisting of some meat or a flour dish. Wine, diluted with plain or mineral water, or beer is the common beverage.

The bread used by this class is rarely made of pure white flour; it is rather of a coarser quality. The bread most largely used is made of rye flour, occasionally mixed with barley flour. The rest of the population, engaged chiefly in agriculture, live mostly on milk, bread, cheese, bacon, vegetables, flour dishes, potatoes, corn porridges and, occasionally on Sundays and festival days, fresh meat. Of course, there is some, although not a very wide, difference between the food of the agricultural laborer and that of the peasant proprietor of small holdings. Along the larger rivers, where fish are abundant, the diet of the agricultural classes includes fish. Wine, in the wine-growing districts, and whisky, where no wine is made, are their chief beverages. The bread used is rarely made of wheat flour, except on festive occasions, when it is called in the vernacular "kalacs" (cake) to distinguish it from the rye bread generally used. The rye bread is coarse and dark, of better quality, occasionally mixed with wheat flour in lower and central Hungary and almost black in upper Hungary. Corn bread is largely used by the Roumanians in Transylvania.

The perfection of all the mechanical contrivances employed by the milling industry in Hungary and its extraordinary development are well known in the United States. But what may be less known is the extraordinary care with which the wheat growers, as well as the mills, co-operate to produce the finest quality of flour by assorting, classifying and thoroughly cleansing the different qualities of wheat grown. They used to produce as many as eighteen grades, but now these are reduced to about seven. The uniformity and reliability of these grades have contributed more than anything else to the success of Hungarian flour. It is claimed besides that the Hungarian flour is possessed of a peculiar buoyancy which makes it better adapted for bakers than any other flour, and this quality is attributed to a nice mixture of different brands of wheat, which is kept secret by the mills. While there are about fourteen large first-class flouring mills in Budapest, there are about 120 more scattered over the country, for the most part near the centers of wheat-growing districts. This proximity has the advantage of educating the farmer as to the needs of the miller, and at the same time it secures the grower a ready market and cash for his produce.

CRYOSTASE is the name conferred by a German chemist (Natur) upon a newly discovered body possessing the unusual property of being liquid at a temperature below the freezing point and solidifying under the influence of heat—in which respect it is absolutely unique. This body may be obtained by mixing together equal parts of phenol, camphor and saponin, to which is added a slightly smaller quantity of oil of turpentine.

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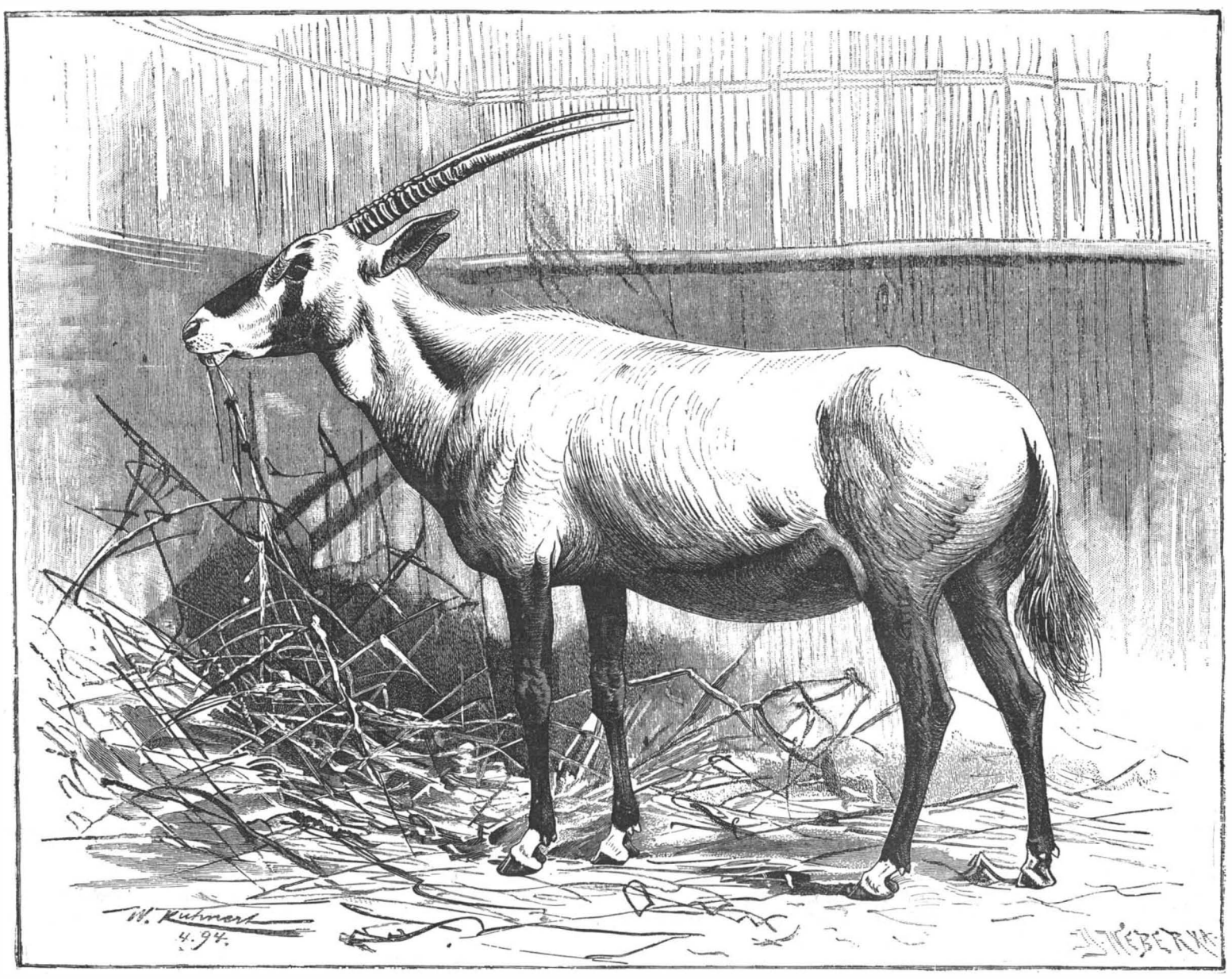
THE BEATRICE ANTELOPE IN THE ZOOLOGICAL GARDEN IN BERLIN.

Arabia is one of those lands in which the animal world has been only very insufficiently investigated. Climatic difficulties, the reserved nature of the natives, and, perhaps, the limited prospect of making discoveries that would astonish the world, have restrained zoologists from penetrating into this interesting territory, doubly interesting because of the fact that within the limits of Arabia the Ethiopian and Asiatic fauna meet. It can generally be assumed that the Tropic of Cancer is the dividing line, so that from a zoological point of view southern Arabia, between Mecca and Muscat, might be considered as belonging to Africa, while in the larger northern portion Syrian and Persian forms are found. In the district south of Roba el Khali, the ill-famed sandy desert west of Oman, which is bounded by the Gulf of Aden, only a few large mammals are found, such as the baboon, the gazelle, etc. The accounts of the natives lead us to suppose that there are lions and panthers in this part of the country, but the astonishment of the scientific world was great when, twenty years ago, it was learned that eastern Arabia was the home of a great antelope.

The Beatrice antelope is one of the most expensive rarities in a zoological collection. Only a few specimens have been brought to Europe alive; but a short time ago one was successfully landed and now is an ornament of the Berlin Zoological Garden. The Beatrice antelope, or so-called spiessbok, is characterized by its long horns, which are straight or only slightly bent, and are annulated only at the roots. They extend backward almost parallel, or slightly divergent. Six representatives of this group are now known, the gemsbok of southwestern Africa, the pinselohr or brush-eared antelope of German East Africa, the beisa of the Somali coast, the Beatrice antelope of southern Arabia, the sable antelope of the eastern Soudan, and the aschamel antelope of northwestern Africa. The Arabian spiessbok, as our antelope might be called, is a beautiful animal of slender build, with delicately modeled head and strong legs. The body is white, but the bush on the tail, the breast, the legs, the ridge of the nose, and the cheeks are dark brown.

I cannot say anything in regard to the habits of these antelopes, for no European has seen them when free. It is only known that they live south of Muscat, and that another specimen was sent from Hodeida, on the Gulf of Aden, to England. Latterly Oscar Neumann, during a short sojourn at Lahadj, north of Aden, gained a little information which seems to indicate that the Beatrice antelope lives in small herds on the stony ridges that bound the desert. The accompanying illustration is from a drawing made by the animal painter Wilhelm Kunnert from the specimen in the Berlin Zoological Garden.—Paul Matschie, in the Illustrirte Zeitung.



THE BEATRICE ANTELOPE IN THE ZOOLOGICAL GARDEN IN BERLIN.

Snake Swallowed by Snake.

One of the strangest incidents in the experience of the management of the Zoological Society's menagerie has occurred, says the London Times, in the reptile house, the scene being one of the compartments in which the boa constrictors are confined. Two large boas occupied the chamber, one snake being 9 ft. and the other 8 ft. long. When the house was opened in the morning only one boa was found in this cage; the other had disappeared. Though the survivor was only a foot longer than the other snake, there was no reason to doubt that it had completely swallowed its companion. It was so distended that the scales were almost separated, and it was unable either to coil itself or to move. There is every reason to believe that in accomplishing this almost incredible feat the snake acted by mistake, and that it devoured its companion by what deserves to be called an accident. The larger boa was fed with a pigeon before the house was closed for the night. It swallowed the bird, and the other boa was then given a pigeon, which it had begun to swallow when the snakes were left for the night. It is believed that the larger snake then caught hold of the part of the pigeon which projected from the other's mouth, and gradually enveloped, not only the bird, but the head of the other snake. Once begun the swallowing process would go on almost mechanically. As the swallowed snake was only one foot less in length than the swallower and of nearly equal bulk, weighing about 50 lb., the gastric juices must have dissolved the portion which first entered the snake's stomach before the remainder was drawn into the jaws. Though still rather lethargic, the surviving boa is not injured by its meal. It coils itself up without difficulty, and its scales have the beautiful iridescent bloom peculiar to the skin of snakes when in perfect health.

Babylonian Antiquities.

Since the British Museum researches in Babylonia ceased, at the end of 1882, the spade of the Arab digger has been at work for the benefit of different Bagdad dealers in antiquities, but with no little loss to science, seeing that for every object found by the lawless excavator about half a dozen valuable antiquities are destroyed.

Both the French and the Americans have been digging in Southern Babylonia for some years past; the former at Tel-Loh, and the latter at a mound called "Niffir," where formerly Layard and Loftus excavated. With the exception of a few objects which have made their way to France and America, whatever they found has been taken possession of by the Ottoman authorities. It may be remembered that since Mr. Rassam's exceptional privileges, obtained for him by the late Sir Henry Layard while ambassador in Constantinople, which enabled him to send to the British Museum everything he found in Assyria, Babylonia, and Armenia, the Porte has persistently refused to allow the agents of foreign museums to appropriate or export any antiquities out of Turkey. The consequence is that whatever is found in the excavations or obtained by purchase by such agents is taken possession of by the Turkish government. Under these rules no fewer than forty-seven cases of antiquities from the American diggings and about 12,000 inscribed clay tablets of those of the French, discovered by M. Sarzac at Tel-Loh, have been appropriated by the imperial delegate and sent to Constantinople.

At Sippara, or Sepharvaim (the site of which was discovered by Mr. Rassam for the British nation about 14 years ago), the Ottoman authorities have been carrying on lately extensive operations under the superintendence of a Latin priest. At that place a large collection of inscribed clay tablets have been found and dispatched to the Turkish capital. According to calculation, there must be at the present time no fewer than 50,000 newly discovered inscribed objects at the Imperial Ottoman Museum in Constantinople, obtained from different Babylonian sites, and the Assyrian scholar may find there ample store for his study, which might add materially to the existing knowledge of the ancient history of Chaldea and Assyria.

Two black basalt statues, covered with fine inscription, have also been found, by the Arabs; one at Imjaileeba, the site of the great palace of the kings of Babylon, where Belshazzar was supposed to have held his impious feast, and the other in a cave near Nimroud, on the opposite side of the Tigris, about 20 miles to the south of Mossul. These images have also been appropriated by the Ottoman authorities and sent to Constantinople.

The greatest find by Arab diggers of inscribed objects that has come to light lately was at Tel-Loh, after M. Sarzac, the French agent, left. They discovered a large chamber full of inscribed clay tablets, most of which they sold to Armenian, Syrian, and Jewish brokers for exportation to England, France, Germany, and America. Part of the collection has already reached London and Paris, but the remainder has been seized by the Ottoman authorities at Bagdad.

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Luminescent Electric Lights.

Mr. H. Ebert recently contributed a paper of great interest to Wiedemann's Annalen on the production of light by high frequency currents, in which results are indicated which are likely to prove of the utmost importance. The fundamental difference between the light and that associated with Tesla's name seems to be in an insistance upon the principle of resonance. He says that it is not necessary to use high tensions, since it has been found that intense light effects can be produced by the movement of exceedingly small quantities of electricity, provided only that the oscillations follow each other regularly and are persistent. The luminous substance of Ebert's "luminescent" lamp is said to be a small disk of compressed luminous paint. This is inclosed in an exhausted glass receiver upon the external surface of which are glued two strips of tinfoil, to which the terminals of the circuit are attached. When the electric oscillations act upon these coatings, active cathode rays are formed on the inner surface. These, though almost invisible themselves, produce a strong luminescent light upon the surface of the luminous paint.

To determine the efficiency of the lamp, it was compared with the amyl acetate standard. Its candle power was found to be about one-thirtieth of this, which is approximately equal to the standard candle. It was found that the energy actually expended in producing this light was only about one millionth of a watt.

Manufacture of Aluminum.

The suit between the Pittsburg Reduction Co., owners of the Hall patent, and the Cowles Electric Smelting and Aluminum Co. was decided some time ago by Judge Taft, United States Circuit Court, Ohio, in favor of the Pittsburg Co. The judge in his decision gives the following interesting explanation of the Hall electric process for making aluminum:

Electrolysis is a process for separating a chemical compound into its elements by passing through it an electric current. The current is effective for this purpose only when the compound is reduced to a liquid state, either by solution or fusion. The compound which is decomposed by the current is called the "electrolyte."

Aluminum is a metal which was first isolated by Wohler in 1827. There is great difficulty in obtaining the pure metal from its compounds because of the tenacity with which it unites with other substances. The compounds of aluminum are very abundant in nature. The most common, perhaps, is the oxide of aluminum, called "alumina," one molecule of which is composed of three atoms of oxygen and two atoms of aluminum. Alumina is insoluble in water and practically infusible.

Fluorine unites with the metals to form fluorides. The fluoride of sodium and the fluoride of aluminum united form what is known as the "double" fluoride of aluminum and sodium. There are several minerals found in nature which are double fluorides of aluminum and sodium, of which cryolite is much more common than the others and is found in large quantities in Greenland. Its uses are so extensive that it has become a well known article of commerce.

More than fifty metals are known to chemists. When one of these is united with non-metallic substances and the compound is reduced to a liquid state by solution or fusion and subjected to an electric current which decomposes it, the non-metallic element of the compound will be drawn by the current to that point in the bath where the current enters it from the positive pole, called the "anode," and the metal will move in the direction of the point where the current leaves the bath for the negative pole, called the "cathode." Metals differ, however, in the ease with which the current can draw them to the cathode, and when one is more sluggish than another in yielding to this influence, the one is said to be more electropositive than another. Scientists have arranged all known metals accordingly.

The only metals more electropositive than aluminum are magnesium, calcium, strontium, barium, lithium, sodium, potassium, rubidium, and caesium. All other metals yield more readily to the current. When several compounds in solution or fusion are electrolyzed, the current will attack and decompose that compound whose parts are least firmly united, or, as the phrase is, which is least stable. As might be supposed from the foregoing, the more electropositive a metal is, the more stable its compounds are likely to be. Alumina is so common in nature that every one, in a desire to get pure aluminum, would naturally turn to that as one of the simplest of its compounds, but the fact that the oxygen has proved to be so firmly united to aluminum as to resist the action of the highest heat has been very discouraging to chemists. Hall, the original patentee of the patent in suit, was a resident of Oberlin, Ohio, and a graduate of the college of that place. He had a strong taste for chemistry, and after leaving college in 1885 gave his attention, among other things, to the aluminum problem, which had baffled so many before him. He conceived the idea of obtaining aluminum from alumina by electrolysis, and concluded that, if he could find a bath made up of compounds more electrically stable than alumina, which would freely dissolve alumina, the application of the current to the mixture would precipitate the aluminum upon the cathode and would free the oxygen at the anode. He discovered that the fluoride of aluminum, when united with the fluoride of any metal more electropositive than aluminum to form a double fluoride, would, when heated to fusion, dissolve alumina as freely as sugar will dissolve in water, and that an electric current passed through the fused mixture would deposit pure aluminum at the poles. Hall took out one patent for the process in which he used a double fluoride of sodium and aluminum, and in this patent he also claimed the general process broadly, as we have stated it above. This is the patent in suit. He also took out other patents, as permitted by the practice of the Patent Office, covering the process when the fluorides or other metals more electropositive than aluminum are used.

The two claims of the patent in suit which are here involved are as follows:

1. As an improvement in the art of manufacturing aluminum, the herein described process, which consists in dissolving alumina in a fused bath composed of the fluorides of aluminum and a metal more electropositive than aluminum, and then passing an electric current through the fused mass, substantially as set forth.

2. As an improvement in the art of manufacturing aluminum, the herein described process, which consists in dissolving alumina in a fused bath composed of the fluorides of aluminum and sodium, and then passing an electric current, by means of a carbonaceous anode, through the fused mass, substantially as set forth.

A DISPATCH from Ishpeming, Mich., states that as men were prospecting for a continuation of the Ropes gold mine vein, a short distance from the main shaft rock containing bismuth, a mineral entirely new to the Upper Peninsula, was discovered. From present indications a large quantity of the mineral exists.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Otto G. Ogden, Louisville, Ky. This is a coupling device of the side-latching type, arranged to reliably interlock with a similar coupling on another car or adjustable to permit of conveniently coupling with the ordinary link and pin devices. An L-shaped latch block is pivoted between two jaws in the front portion of a forwardly recessed drawhead, and a spring-pressed dog slides vertically in the upper side of the block to lock it in open adjustment. The coupling operates to couple automatically two meeting cars fitted with the improvement.

CABLE GRIP.—George C. Ormerod and John H. Charles, Asbury Park, N. J. A leading feature of this invention is a vertically movable slide frame having opposite spring members at its lower end, these members carrying jaws to engage the cable, and there being inclined blocks on the outer sides of the members, vertically movable rollers running on the blocks. The improvement affords a simple, strong, and efficient grip, which may be attached to an ordinary car and operated by the customary brake and grip shaft, its jaws being quickly clamped on and released from the cable, and the grip being readily raised and lowered.

SEAL LOCK.—Thomas Gaskins, Arcadia, Fla. This is a simple, accurate, and inexpensive seal to readily indicate whether the car has been opened, the inspector being able to see at a glance by the flash of his lantern at night whether the seal has been tampered with. The seal box has a main and a movable section, a slide fitted to the box holding the sections closed when inserted, and one of the parts having a card receiver, while the other has a marker. After the seal is applied to a car, the only further cost attending its use is the light one of the cards employed.

CAR BRAKE SHOE AND DRESSER.—James E. Warswick, Americus, Ga. To keep that part of the wheel or flange which does not come in contact with the rail to its original shape, this improvement affords an inexpensive device designed to maintain a perfect cutting surface at all times in the face of the shoe. The shoe or dresser has a body portion of soft iron, while a hardened steel portion extends in sinuous and angular form from end to end of the shoe, forming transverse reversely curved cutting members, the soft body having depressions on alternate sides of the reverse curves of the cutting portions.

Mechanical.

MECHANICAL MOVEMENT.—Isaac S. Bryant, La Junta, Col. This is an improvement on a former patented invention of the same inventor, for converting reciprocating into rotary motion in a simple and effective manner, at the same time avoiding all dead centers. On a crosshead whose central portion moves in the slideways of a frame are rigidly clamped end jaws, and other jaws pivoted on each side of the slideways, with their outer ends extending in opposite directions, and a reciprocating rod is pivotally connected with the inner ends of the pivoted jaws, the rod and the crosshead being arranged essentially in longitudinal alignment, while an endless chain passes between the pivoted and the clamping jaws.

MOTOR.—George W. Browne and John W. Little, Brooklyn, N. Y. This motor is especially adapted to be operated by water, but may also be operated by steam or compressed air. It is simply and inexpensively built, is very compact, and is designed to be very effective. It has two cylinders, the pistons in which actuate the drive shaft through cranks, piping provided with inlet and exhaust being connected with the cylinders, and there being in the piping opposing valve casings and connected valves simultaneously operated. A weighted trip arm is connected with the valves, and a trip shaft connected with the arm is rocked from the drive shaft.

PUMP.—Edwin M. McGee, Carleton, Neb. This is a simple and easily operated instrument for use either as a suction or injecting pump. It has two nipples, one for injection and the other for ejection, and by simply turning a plug in the instrument the action of the valves is reversed and water which has been injected through one nipple may be drawn back through the same nipple and ejected through the other nipple. The construction is such that all the parts may be conveniently removed for cleaning or renewal.

VALVE OPERATING DEVICE.—Charles Otis, New York City. This inventor has devised means for automatically opening and closing the throttle valve of a pump by which water for operating an elevator is pumped, the devices being actuated to open and close the valve by the rising and falling of a float in one of the tanks. Combined with a yoke pivoted to rock and having connection with the valve is a float connected with the yoke and controlled by a weighted cord or chain, there being a shifting weight on the yoke, and a counteracting weight connected by a cord or chain to the yoke.

DRILLING MACHINE.—Wendell P. Norton, Torrington, Conn. This is a machine of simple construction, adapted for use as a single or duplex drill, and more especially designed for drilling and reaming lathe spindles, billets, ingots, bars, and other bodies requiring a comparatively long but straight and true hole throughout their entire length. The invention consists principally of a hinged work-supporting head adapted to swing in or out of alignment with the drill or drills, the head carrying a revoluble chuck head.

Electrical.

ELECTRO-MAGNETIC SWITCH.—John G. Hartel, Keokuk, Iowa (deceased), Florence L. Hartel, administratrix. According to this improvement the switch is held in closed position by a spring-actuated catch with which is connected a releasing mechanism, there being an armature placed on the field magnet of the motor and connected with the releasing lever. The device is especially designed to prevent the burning out of motors when the current comes into the wire after having been interrupted.

Agricultural.

HAND CULTIVATOR.—Edward Franklin, Boston, Ga. This is an implement designed to be especially advantageous for use as a garden plow, the oblique downward pressure of ordinary plows being dispensed with, and force being required only in a forward and horizontal direction. The wheel of the cultivator is relieved of the usual downward pressure, and travels easily over the ground, all the weight of the implement being sustained by the slide or heel of the plow. The implement runs very lightly, and may be built to have little weight of itself.

BAND CUTTER AND FEEDER FOR THRASHERS.—Michael G. Schauer and Alden A. Bartlett, Pipe Stone, Minn. This is an improvement upon an invention patented in 1891, according to which the various parts are compactly and simply geared together and operated in perfect unison. The invention provides an auxiliary or lower feed board which forces or carries the chopped or divided material to the thrasher cylinder, even should the upper set of feed devices fail to act, but when the two feed devices act together a perfect and regular feed is secured, although the knives are carried only by the upper feed devices. The construction of knives provides for the removal of individual groups of blades for the repair or replacement of broken sections or cutters.

Miscellaneous.

COAL OR ORE SEPARATING APPARATUS.—Frank Pardee, Hazleton, Pa. To conveniently separate coal from slate, and ores from their impurities, or a heavy from a light material, this invention provides a tank with inclined bottom, and a delivery chute at its upper end, an endless traveling belt being arranged parallel to the bottom, the belt being held in a movable frame, which has a reciprocating motion, while the belt travels longitudinally. The material carried through the water is thus subjected to a shaking motion and a floating action, to separate the lighter from the heavier particles, and carry the latter out of the tank.

REMOVING WATER OR OIL FROM GAS WELLS.—Raleigh H. Staley, Sheridan, Ind. According to this invention the gas is confined in the well to raise the water or oil in the pipe provided for its overflow, a jet of gas being then returned and discharged through a smaller pipe into the upper end of the raised column of water or oil, just below its surface, thus causing a continuous flow of liquid at the top of the well. The improvement also provides for the separation of any gas that may rise through the fluid outlet, conducting such gas to a place of storage or use.

SELF-LOADING CART.—George F. Fischer, Rochester, N. Y. This invention provides an improvement in two-wheeled carts, and one capable of effective service as a military transport, or in a rough country, where skilled labor is not available. Its construction is such that the contents may be dumped in a heap or distributed and leveled over a given surface, this being effected from either the front or back of the cart, whose frame and body may be lowered to any position on the supporting wheels, and the body may be lowered on the frame and independent of the frame, the front end of the cart being in all respects similar to its rear end.

MANHOLE COVER.—Charles Parkins, Hoboken, N. J. The manhole ring, according to this improvement, has lugs on its inner side, and the cover has inclined ways or grooves to engage the lugs, the grooves having notches in their upper walls, and there being holes in the cover top. The ring and cover cost no more than those in ordinary use, but they are so made that the cover may be quickly placed in position and removed, yet it cannot be accidentally displaced, and cannot be moved except by first lifting it with a suitable tool and then turning it laterally.

CONVEYING MATERIALS.—Frederic E. Duckham, Millwall Docks, London, England. This is a method of elevating and conveying grain and similar substances in bulk by a current of compressed air, and the improvement consists in injecting the air current into the midst of the grain within a closed chamber, the grain being fed by gravity directly into the path of the blast, to be carried thereby as fast as it is fed in an upward direction, the exit of the grain being in inverse direction to the feed. The blast and exit nozzles are adjustable relatively to one another to vary the interven ing space.

GRAIN CONVEYOR.—This is a further patent of the same inventor for an improvement according to which the exit nozzle has its mouth opening downward, a surrounding air blast sleeve being in communication at its upper end with a compressed air supply pipe, and there being an inclosing chamber within which the nozzle and sleeve are immersed in the midst of a mass of grain to be elevated, the chamber having an air lock or equivalent means of charging it with grain without permitting the escape of air.

PNEUMATIC GRAIN CONVEYOR.—Another patent by the same inventor, for similar purposes, provides for an exit nozzle having its opening downward, while an upwardly directed air blast nozzle is arranged in substantial axial alignment with the exit nozzle, and located near the lower part of a closed chamber containing the mass of grain in the midst of which the nozzles are immersed. The nozzles are separated by such an interval that the grain can flow by gravity directly into the path of the blast, the distance between the nozzles depending upon the angle of repose of the grain, the amount of air pressure, and other variable working conditions.

DREDGING APPARATUS.—Frank A. Hyatt, Beaumont, Texas. In this dredge a frame is pivoted to a plow having a rear concave side, there being an endless chain elevator running on drums in the frame, the lower drum being arranged in the concave and the buckets of the elevator being hinged and adapted to fold parallel to the frame. Attached to the under side of the frame are guide bars which have their lower ends in coincidence with the concave of the plow. The frame is supported at a suitable angle in operation, and the scoop hinged to its lower end works horizontally.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

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NEW BOOKS AND PUBLICATIONS.

GEOLOGICAL GUIDE BOOK FOR AN EXCURSION TO THE ROCKY MOUNTAINS. Samuel Franklin Emmons, Editor. New York: John Wiley & Sons. 1894. Pp. 257 to 487. Price $1.50.

This book is excellently described by its title. It is a series of monographs on the geology of America, and it is preceded by a map giving the divisions under which the subject is treated, with the railroad routes by which the localities are reached. It was designed for immediate use on the occasion of the Geological Congress, and forms an admirable resume of the geology of America. Additional maps and illustrations are given as required to elucidate the text.

PRACTICAL LESSONS IN PHYSICAL MEASUREMENT. By Alfred Earl. London and New York: Macmillan & Co. 1894. Pp. xv, 350. Price $1.25.

In the three hundred and fifty pages of this book we have the science of measurement—for such physics has been called—treated on the meaurement basis. The entire work is devoted to measurement and similar physical topics. It is illustrated as required, and is undoubtedly of value. The impression produced by works of this kind, however, is that too much space is devoted to too little, and the authors of these works seem to be impressed with the necessity of working with simple apparatus, while the measurement of physics should be carried out by the use of the best apparatus which can be obtained. One is a scientific study of the subject, and the other scientific gymnastics.

COAL DUST AN EXPLOSIVE AGENT. By Donald M. D. Stuart, F.G.S. New York: Spon & Chamberlain. Seven plates.

This book is the result of a thorough personal investigation by the author into the causes of an explosion at the Camerton Collieries, Somersetshire, England, which occurred Nov. 13, 1893. It was a non-gaseous mine, and the explosion was necessarily caused by an agent other than fire damp. The author finds coal dust, under some circumstances, an explosive agent, as well as a ready producer of gases which may propagate a highly dangerous and extensive explosion.

LAMPS OF THE TEMPLE. Compiled by Thomas W. Handford. Chicago: Laird & Lee. Pp. 374. Cloth, 50 cents.

This is a collection of examples of the eloquence of the modern pulpit, being short selections from the sermons or speeches of the leading pulpit orators of the present generation. They are brief discourses, which may well engage a leisure hour now and then of the most matter-of-fact men.

FORMER CLOCK AND WATCH MAKERS AND THEIR WORK. By F. J. Britten. London: E. & F. N. Spon. New York: Spon & Chamberlain. 1894. Pp. viii, 397. Price $2. No index.

This work contains in addition to the interesting text some five thousand names of clock makers of the past and present, and numerous illustrations of antique and modern clocks and other historical features. It should certainly be commended for its interest. Clocks have formed a subject of study and reading with many not concerned in the actual business; to such the present work will be invaluable. While it is written, to a certain extent, from the English standpoint, it will be found of value to all. The absence of a table of contents and index lays it open to a very severe criticism, as their presence would have immensely increased its utility.

MERCHANTS' BLACK LIST. For keeping a record of delinquent accounts. Detroit, Mich.: The Bookkeeper Publishing Co. 1894. Pp. 182.

This is a volume of printed forms for names, addresses, etc., of non-paying debtors. A page is devoted to each party, and it is to be hoped that any one possessing such a book will find that it will last them for many years.

FRUIT CULTURE FOR PROFIT. By C. B. Whitehead. London: Society for Promoting Christian Knowledge. New York: E. & J. B. Young & Co. 1894. Pp. 86. Price 40 cents. No index.

Fruit culture is here treated strictly from an English standpoint. Thus, in regard to tomatoes, it is stated that "it is very doubtful whether open air culture can be recommended," and it further states that "growing tomatoes under glass for market purposes has in the last few years attained enormous popularity." All this is rather strange reading for Americans.

ELECTRICITY ONE HUNDRED YEARS AGO AND TO-DAY. With copious notes and extracts. By Edwin J. Houston. New York: The W. J. Johnston Company, Limited. 1894. Pp. vi, 199. Price $1.

This very pleasant little work contains the text of a lecture delivered before the electrical section of the Brooklyn Institute. It makes excellent reading and it is very attractively printed. Many quotations from publications of the different epochs are embodied, which give much life to the subject. The book may be commended to all.

EDIBLE AND POISONOUS MUSHROOMS. What to eat and what to avoid. By M. C. Cooke. With eighteen colored plates illustrating forty-eight species. London: Society for Promoting Christian Knowledge. New York: E. & J. B. Young & Co. 1894. Pp. viii, 126. Price $1.40. No index.

The attractive subject of mushrooms is here excellently treated, with numerous colored illustrations to guide the amateur mycologist in his researches. While the author admits that his list of edible mushrooms is comparatively small, he includes all of the best, most available and essential known in the British Islands, and this information will, of course, be to a great extent applicable to the United States.

ELECTRIC LIGHTING PLANTS, THEIR COST AND OPERATION. By W. J. Buckley. Chicago: William Johnston Printing Co. 1894. Pp. iii, 275. Price $2. With index.

Mr. Buckley, in an amusing preface, describes himself as "neither electrician, engineer, nor expert, but a salesman engaged in a noble effort to deserve his salary." Although the work applies to the apparatus of the Fort Wayne Electric Corporation, it will be found very applicable to the work of all electrical engineers.

"Heat Insulation and Fire Protection in Prominent Buildings" is the title of a pamphlet just issued by the H. W. Johns Manufacturing Company, but it in no way discourses upon the asbestos pipe and boiler coverings made by the company other than to point to the buildings in which these goods have been used. And the showing is a good one. Twenty pages of beautiful half tones, showing a hundred or more of the best modern structures in the large cities, electric light and cable power stations, factories, etc., in which these coverings have been used, would seem to be better testimony as to their merit than could be adduced in any other form.

COAL MINING MACHINES AND AIR COMPRESSORS.—Advance sheets of the 50th catalogue of the Ingersoll-Sergeant Drill Company are received, containing valuable points on the method of mining coal by machinery, with estimates of cost of mining plants and the saving in cost of output of coal by the use of the new coal-cutting machines over the older method by hand labor alone. The figures are somewhat surprising, bringing the cost of mining coal by machinery down to 28 cents per ton for the run of the mine and 36½ cents screened and on cars at the mine. This is for soft coal, and is of great interest to Western and Southern mining interests.

SCIENTIFIC AMERICAN BUILDING EDITION.

NOVEMBER, 1894.—(No. 109.)

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1. Elegant plate in colors showing a cottage at Bronxville, N. Y., recently erected for B. L. Clark, Esq. Two perspective elevations and floor plans. Estimated cost $5,000. Mr. William A. Lambert, architect, New York City. A modern and pleasing design.
2. Plate in colors showing the residence of John Cottier, Esq., at Bensonhurst, L. I. Three perspective elevations and floor plans. Cost $6,750 complete. A good example of Colonial architecture. Messrs. Parfitt Bros., architects, Brooklyn, N. Y.
3. A dwelling at E ison Park, Ill. Cost $1,700. Architect, Mr. F. W. Langworthy, Chicago, Ill. A model design for its class and cost. Two perspective elevations and floor plans.
4. A very attractive residence recently erected for A. C. Garsia, Esq., at Flatbush, L. I. Two perspective elevations and floor plans. Mr. John E. Baker, architect, Newark, N. J. A modern design.
5. An $800 summer cottage built for A. R. Doten, Esq., at Casco Bay, near Portland, Me. Perspective elevation and floor plans. Mr. Antoine Dorticos, architect, Portland, Me.
6. Perspective elevations and floor plans of a handsome residence recently completed for George W. Catt, Esq., at Bensonhurst, L. I. A very picturesque design. Cost $8,100 complete. Mr. S. S. Covert, architect, New York.
7. A church at Short Hills, N. J., built entirely of rubble stone. Estimated cost $6,000. Perspective elevation and floor plan. Messrs. Lamb & Rich, architects, New York City.
8. The house of Francis I. at Abbeville, France.
9. A stable and conservatory attached to the residence of John Cottier, Esq., at Bensonhurst, L. I. Perspective elevation and ground plan. Messrs. Parfitt Bros., architects, Brooklyn, N. Y.
10. A residence at Ardmore, Pa., in the Queen Anne style. Perspective elevation and floor plans. Cost complete $6,750. Architects and builders, Messrs. J. B. Cornell & Sons, Philadelphia, Pa.
11. A cottage at Edgewater, Ill., erected for Edgar Smith, Esq. A unique design in the Colonial style. Cost $7,800 complete. Two perspective elevations and floor plans. Mr. G. W. Maher, architect, Chicago, Ill.
12. An attractive cottage at Bath Beach, Long Island, N. Y., recently erected for G. W. Snook, Esq. Two perspective elevations and floor plans. Mr. Percey Emmett, architect, Bath Beach, Long Island.
13. Miscellaneous contents.—Wood pavement in London.—Preservation of wood.—Methods of constructing chimney flues and pipes at Paris, illustrated.—The passing of red brick.—Long distance house moving.—Carved and fancy mouldings, illustrated.—A new sash lock.—Automatic heat regulation in houses, etc., illustrated.—Woodwork vs. flame.—Curiosities about wood.—Cement water tanks.—An improved hot water heater. illustrated.—How to cool a cellar.—A new woodworking machine, illustrated.—An improved stage bracket iron, illustrated.—Party walls.—Architectural metal ornaments, illustrated.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6297) C. S. H. writes: 1. In a description of a Wimshurst influence machine, the glass disks were recommended to be one-sixteenth of an inch thick. Would it make any difference in the efficiency of the machine if the disks were made of one-eighth inch glass? A. The thinner the plates are, the better will the machine work. 2. Should the teeth of the collecting combs be allowed to touch the tinfoil sectors? A. No. 3. Can hydrogen gas be exploded if confined in a reservoir by a spark from an induction coil, and if so, what would be the explosive force compared to gunpowder? A. A mixture of hy rogen and oxygen can be thus exploded. For an instant a pretty high pressure will be produced, but not comparable with that due to the explosion of gunpowder. 4. Has any paper been published in the SCIENTIFIC AMERICAN SUPPLEMENT describing a gas engine? A. We refer you for gas engines to our SUPPLEMENT, Nos. 484, 508, 715 and 716. 5. In what proportion are nitric and sulphuric acids mixed to make pyroxyline for an electrophorus? A. For the manufacture of pyroxyline and celluloid we refer you to our SUPPLEMENT, Nos. 227, 265, 817. Also SCIENTIFIC AMERICAN, No. 18, vol. 60, No. 7, vol. 63, No. 3, vol. 67, No. 17, vol. 71. It is better to buy a piece of celluloid than to attempt to make a plate of pyroxyline.

(6298) A. C. B. asks: 1. Is gas burned through a Bunsen burner injurious to health, if supply of fresh air is sufficient in a room? A. It is not injurious if the burner is of proper construction and is in good order. 2. What is the temperature of a Bunsen flame? A. It may rise in the hottest part of the flame to over 2,700° Fah. 3. What is the temperature of a common flame? A. It may rise in the hottest part of the flame to 2,400° Fah. 4. What is the per cent of air burned with a common and with a Bunsen burner? A. Both burn the same, the amount varying with the composition of the gas; about ten of air to one of gas is a fair average for good gas. Flame temperatures depend on the composition of the gas. We have published a number of excellent papers on flame temperatures and the physics and chemistry of flames in our SUPPLEMENT, Nos. 701, 846, 848, 850, 857, 867, 892, 930, 941, 942.

(6299) L. C. K. asks: 1. Is there any waste of zinc or solution in the Disque Leclanche battery when the circuit is open? Is it the same with the Crowfoot cells? A. Practically none in the Leclanche battery; a great deal in Crowfoot cells. 2. The E. M. F. of one Disque Leclanche cell is 1·43 volts, the amperage is 6 to 8; what would be the voltage and amperage of 6 cells and how is the result obtained? A. You give too high an amperage. Such calculations are done by Ohm's law. See Sloane's "Arithmetic of Electricity," $1 by mail. 3. How can an alternating current be changed to direct current without the use of a commutator? I wish to use an electroplater in an electric incandescent circuit. A. You must have an alternating current motor, connected to a direct current plating dynamo. 4. Can India rubber such as used as corks be changed to hard rubber, and how? A. This cannot be done satisfactorily. Heating with sulphur might effect a superficial action, but it would be of no utility.

(6300) W. W. asks: 1. When zinc is forming in strong sulphuric acid, what gas is given off, and is it unhealthy? A. Hydrogen gas is almost always given off in these cases. It carries with it a quantity of sulphuric acid spray and is more or less impure. The gases are rather injurious to health, but the human system seems able to endure a great deal of these emanations without much effect. 2. In sulphuric acid battery, should the surface of the zinc and copper, or zinc and carbon, bear any certain proportion to get best results? A. There is no such proportion; in general the larger the carbon or copper the better. 3. In gravity battery, where does the gravity come into operation? A. The higher specific gravity of the solution of copper sulphate keeps it at the bottom. As soon as the zinc sulphate solution becomes of higher specific gravity, the action of the battery is interfered with. 4. In electro-magnet what would be difference in magnetic strength in the two following cases: 1. Two amperes at 10 volts. 2. Two volts and 10 amperes. A. If the wire was of the same diameter and was wound in superimposed layers, the second case would represent the stronger magnet. It is a question of ampere turns.

(6301) H. N. M. asks: Why is it that the pressure on all the contents of the chest cavity is diminished when an inspiration occurs? A. By the action of the muscles of the diaphragm in great part.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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November 6, 1894,

AND EACH BEARING THAT DATE.

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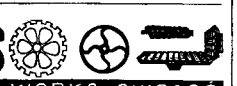
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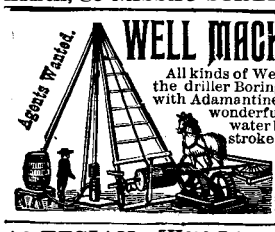

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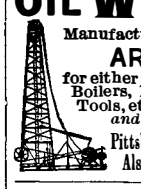
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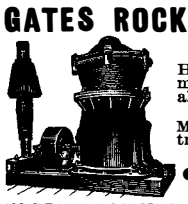
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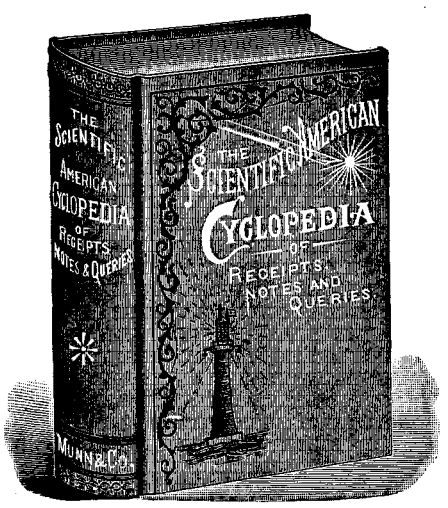

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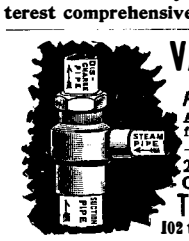

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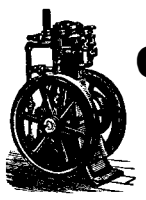

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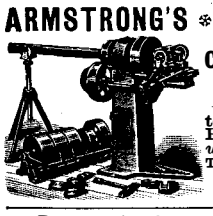

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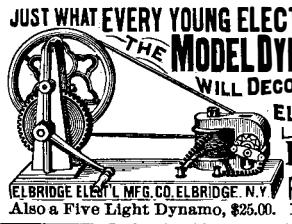

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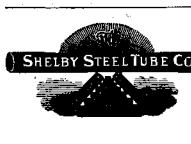

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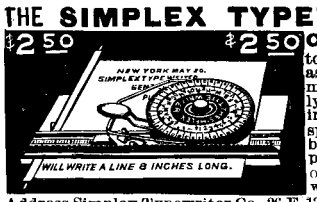

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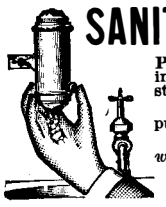

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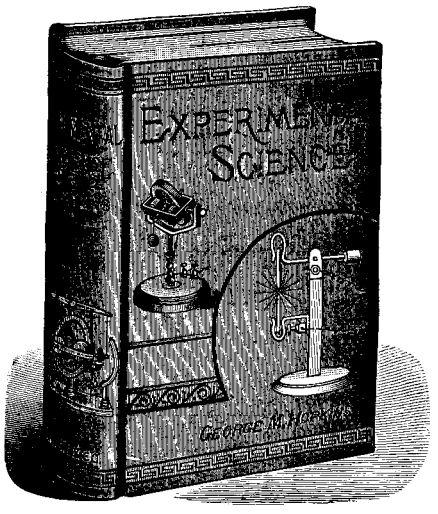

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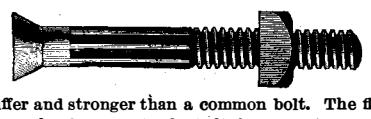

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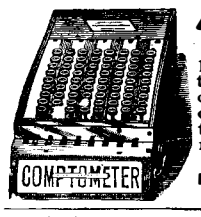

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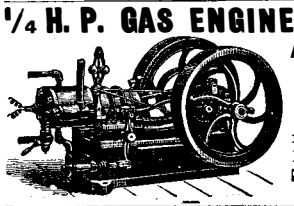

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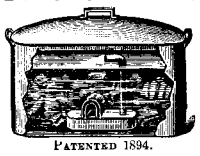

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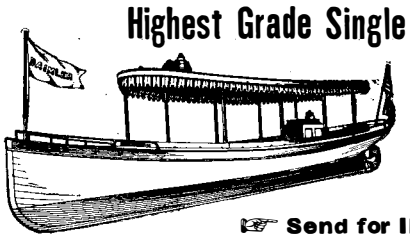

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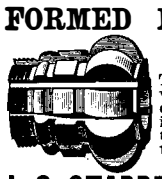

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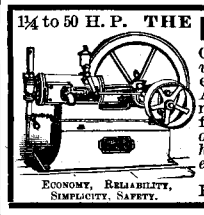

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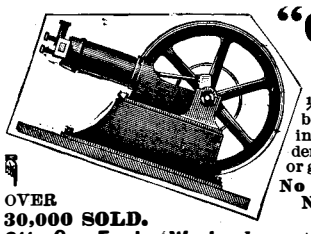

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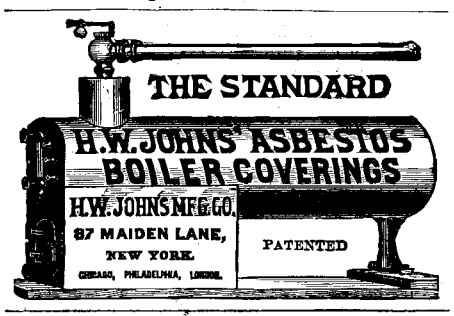

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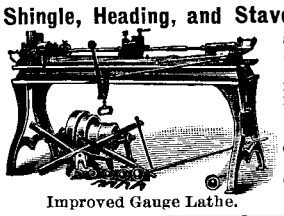

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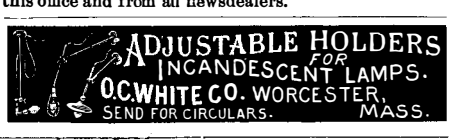

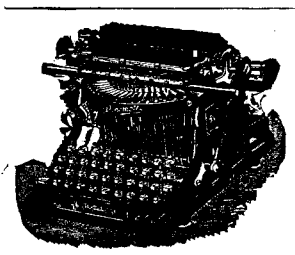

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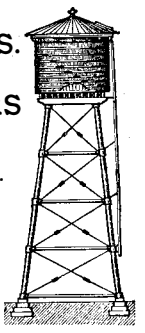

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